



US009464443B2

(12) **United States Patent**
Martensson

(10) **Patent No.:** **US 9,464,443 B2**
(45) **Date of Patent:** **Oct. 11, 2016**

(54) **FLOORING MATERIAL COMPRISING FLOORING ELEMENTS WHICH ARE ASSEMBLED BY MEANS OF SEPARATE FLOORING ELEMENTS**

(71) Applicant: **PERGO (EUROPE) AB**, Trelleborg (SE)

(72) Inventor: **Goran Martensson**, Klagstorp (SE)

(73) Assignee: **PERGO (EUROPE) AB**, Trelleborg (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/086,757**

(22) Filed: **Nov. 21, 2013**

(65) **Prior Publication Data**

US 2014/0157700 A1 Jun. 12, 2014

Related U.S. Application Data

(60) Continuation of application No. 11/185,724, filed on Jul. 21, 2005, now abandoned, which is a division of application No. 10/802,779, filed on Mar. 18, 2004, now Pat. No. 6,920,732, which is a division of application No. 09/806,994, filed as application No. PCT/SE99/01699 on Sep. 27, 1999, now Pat. No. 6,763,643.

(30) **Foreign Application Priority Data**

Oct. 6, 1998 (SE) 9803379-8

(51) **Int. Cl.**

E04F 15/02 (2006.01)

E04F 15/04 (2006.01)

E04F 15/10 (2006.01)

(52) **U.S. Cl.**

CPC **E04F 15/02038** (2013.01); **E04F 15/02** (2013.01); **E04F 15/04** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC E04F 15/04; E04F 2201/0115; E04F 2201/05; E04F 15/02005; E04F 2201/049

USPC 52/395, 463, 471, 586.1, 586.2
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

87,853 A 3/1869 Kappes
108,068 A 10/1870 Utley

(Continued)

FOREIGN PATENT DOCUMENTS

AT 000 112 U2 2/1995
AT 002 214 U1 6/1998

(Continued)

OTHER PUBLICATIONS

Knight's American Mechanical Dictionary, vol. III. 1876, definition of scarf.

(Continued)

Primary Examiner — Elizabeth A Quast

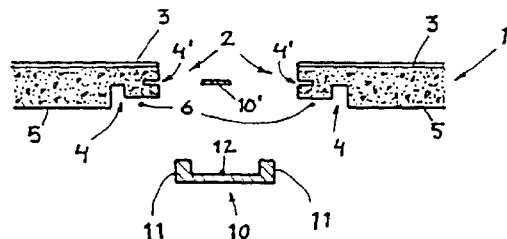
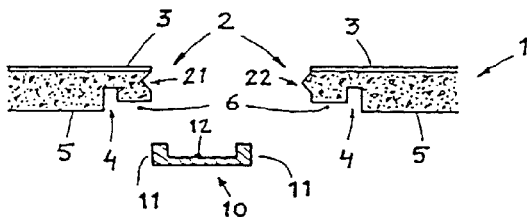
(74) *Attorney, Agent, or Firm* — Jenkins, Wilson, Taylor & Hunt, P.A.

(57)

ABSTRACT

Flooring material comprising board shaped floor elements with a rectangular oblong shape, which are provided with edges, a lower side and a decorative upper surface. The flooring material further includes joining profiles separate from the basic material of the floor elements. The floor elements may become fixed adjacent to each other, wherein the fixation is effective both horizontally and vertically. The vertical fixation is obtained through at least one of the joining profiles, which is not involved in the horizontal fixation.

18 Claims, 5 Drawing Sheets



(52) U.S. CL.

CPC *E04F 15/102* (2013.01); *E04F 2201/0115*
(2013.01); *E04F 2201/0138* (2013.01); *E04F*
2201/028 (2013.01); *E04F 2201/0517*
(2013.01); *E04F 2201/0529* (2013.01)

(56)

References Cited

U.S. PATENT DOCUMENTS

208,036	A	9/1878	Robley	1,864,774	A	6/1932	Storm
213,740	A	4/1879	Conner	1,477,813	A	12/1932	Daniels et al.
274,354	A	3/1883	McCarthy et al.	1,898,364	A	2/1933	Gynn
308,313	A	11/1884	Gerike	1,906,411	A	5/1933	Potvin
338,653	A	5/1886	Whitmore	1,913,342	A	6/1933	Schaffert
342,529	A	5/1886	McRae	1,929,871	A	10/1933	Jones
502,289	A	8/1893	Feldman	1,940,377	A	12/1933	Storm
662,458	A	11/1900	Nagel	1,946,646	A	2/1934	Storm
713,577	A	11/1902	Wickham	1,953,306	A	4/1934	Moratz
714,987	A	12/1902	Wolfe	1,966,020	A	7/1934	Rowley
752,694	A	2/1904	Lund	1,978,075	A	10/1934	Butterworth
753,791	A	3/1904	Fulghum	1,986,739	A	1/1935	Mitte
769,355	A	9/1904	Platow	1,988,201	A	1/1935	Hall
832,003	A	9/1906	Torrence	1,991,701	A	2/1935	Roman
847,272	A	3/1907	Ayers	2,004,193	A	6/1935	Cherry
877,639	A	1/1908	Galbraith	2,015,813	A	10/1935	Nielsen
890,436	A	6/1908	Momberg	2,027,292	A	1/1936	Rockwell
898,381	A	9/1908	Mattison	2,044,216	A	6/1936	Klages
1,000,859	A	8/1911	Vaughan	2,045,067	A	6/1936	Bruce
1,002,102	A	8/1911	Weedon	2,049,571	A	8/1936	Schuck
1,016,383	A	2/1912	Wellman	2,088,405	A	7/1937	Cahn
1,078,776	A	11/1913	Dunton	2,100,238	A	11/1937	Burgess
1,097,986	A	5/1914	Moritz	RE20,816	E	8/1938	Haase
1,124,226	A	1/1915	Houston	2,126,956	A	8/1938	Gilbert
1,124,228	A	1/1915	Houston	2,138,085	A	11/1938	Birtles
1,137,197	A	4/1915	Ellis	2,141,708	A	12/1938	Elmendorf
1,140,958	A	5/1915	Cowan	2,142,305	A	1/1939	Davis
1,201,285	A	10/1916	Gray	2,194,086	A	3/1940	Horn
1,266,253	A	5/1918	Hakason	2,199,938	A	5/1940	Kloote
1,319,286	A	10/1919	Johnson et al.	2,222,137	A	11/1940	Bruce
1,357,713	A	11/1920	Lane	2,226,540	A	12/1940	Boettcher
1,371,856	A	3/1921	Cade	2,238,169	A	4/1941	Heyn et al.
1,407,679	A	2/1922	Ruchrauff	2,245,497	A	6/1941	Potchen
1,411,415	A	4/1922	Cooley	2,253,943	A	8/1941	Rice
1,436,858	A	11/1922	Reinhart	2,261,897	A	11/1941	Adams
1,454,250	A	5/1923	Parsons	2,263,930	A	11/1941	Pasquier
1,468,288	A	9/1923	Fen	2,266,464	A	12/1941	Kraft
1,510,924	A	10/1924	Daniels et al.	2,740,167	A	3/1942	Scull
1,540,128	A	6/1925	Houston	2,280,071	A	4/1942	Hamilton
1,575,821	A	3/1926	Daniels	2,282,559	A	5/1942	Byers
1,576,527	A	3/1926	McBride	2,324,628	A	7/1943	Kahr
1,576,821	A	3/1926	Daniels	2,360,933	A	10/1944	Bunker
1,602,256	A	10/1926	Sellin	2,363,429	A	11/1944	Lowry
1,602,267	A	10/1926	Karwisde	2,381,469	A	8/1945	Sweet
1,615,096	A	1/1927	Myers	2,398,632	A	4/1946	Frost et al.
1,622,103	A	3/1927	Fulton	2,405,602	A	8/1946	Nugent
1,622,104	A	3/1927	Fulton	2,430,200	A	11/1947	Wilson
1,637,634	A	8/1927	Carter	2,441,364	A	5/1948	Maynard
1,644,710	A	10/1927	Crooks	2,487,571	A	11/1949	Maxwell
1,657,159	A	1/1928	Greenebaum	2,491,498	A	12/1949	Kahr
1,660,480	A	2/1928	Daniels	2,534,501	A	12/1950	Coleman
1,706,924	A	3/1929	Kane	2,644,552	A	7/1953	MacDonanld
1,714,738	A	5/1929	Smith	2,717,420	A	9/1955	Georges
1,718,702	A	6/1929	Pfiester	2,729,584	A	1/1956	Foster
1,723,306	A	8/1929	Sipe	2,780,253	A	2/1957	Joa
1,734,826	A	11/1929	Pick	2,805,852	A	9/1957	Ewert
1,736,539	A	11/1929	Lachman	2,808,624	A	10/1957	Sullivan
1,743,492	A	1/1930	Sipe	2,823,433	A	2/1958	Kendall
1,764,331	A	6/1930	Moratz	2,839,790	A	6/1958	Collings
1,772,417	A	8/1930	Ellinwood	2,857,302	A	10/1958	Burton et al.
1,776,188	A	9/1930	Langbaum	2,863,185	A	12/1958	Reidi
1,823,039	A	9/1930	Gruner	2,865,058	A	12/1958	Andersson et al.
1,778,069	A	10/1930	Fetz	2,875,117	A	2/1959	Potchen et al.
1,787,027	A	12/1930	Wasleff	2,878,530	A	3/1959	Hilding
1,801,093	A	4/1931	Larkins	2,894,292	A	7/1959	Gramelspacher
1,843,024	A	1/1932	Werner	2,914,815	A	12/1959	Alexander
1,854,396	A	4/1932	Davis	2,926,401	A	3/1960	Place
1,859,667	A	5/1932	Gruner	2,947,040	A	8/1960	Schultz
				2,831,223	A	9/1960	DeShazor
				2,952,341	A	9/1960	Weiler
				2,974,692	A	3/1961	Bolenbach
				2,996,751	A	8/1961	Roby
				3,039,575	A	6/1962	Graham
				3,040,388	A	6/1962	Conn
				3,045,294	A	7/1962	Livezey, Jr.
				3,090,082	A	5/1963	Bauman
				3,100,556	A	8/1963	Ridder
				3,125,138	A	3/1964	Bolenbach
				3,128,851	A	4/1964	Deridder et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

3,141,392 A	7/1964	Schneider	3,720,027 A	3/1973	Christensen
3,145,503 A	8/1964	Brechin	3,731,445 A	5/1973	Hoffmann et al.
3,148,482 A	9/1964	Neale	3,740,914 A	6/1973	Arnaiz Diez
3,162,906 A	12/1964	Dudley	3,742,672 A	7/1973	Schaeufele
3,172,508 A	3/1965	Doering et al.	3,745,726 A	7/1973	Thom
3,174,411 A	3/1965	Oestrich et al.	3,758,650 A	9/1973	Hurst
3,175,476 A	3/1965	Franks	3,759,007 A	9/1973	Thiele
3,182,769 A	5/1965	De Ridder	3,760,544 A	9/1973	Hawes et al.
3,192,574 A	7/1965	Jaffe et al.	3,760,548 A	9/1973	Sauer et al.
3,199,258 A	8/1965	Jentoft et al.	3,761,338 A	9/1973	Ungar et al.
3,200,553 A	8/1965	Frashour et al.	3,768,846 A	10/1973	Hensley et al.
3,203,149 A	8/1965	Soddy	3,778,958 A	12/1973	Fowler
3,204,380 A	9/1965	Wilson	3,780,469 A	12/1973	Hancovsky
3,205,633 A	9/1965	Nusbaum	3,786,608 A	1/1974	Boettcher
3,253,377 A	5/1966	Schakel	3,798,111 A	3/1974	Lane et al.
3,257,225 A	6/1966	Marotta	3,807,113 A	4/1974	Turner
3,267,630 A	8/1966	Omholt	3,808,030 A	4/1974	Bell
3,282,010 A	11/1966	King, Jr.	3,810,707 A	5/1974	Tungseth et al.
3,286,425 A	11/1966	Brown	3,849,111 A	11/1974	Kihlstedt
3,296,056 A	1/1967	Bechtold	3,849,240 A	11/1974	Mikulak
3,301,147 A	1/1967	Clayton et al.	3,859,000 A	1/1975	Webster
3,310,919 A	3/1967	Bue	3,883,258 A	5/1975	Hewson
3,313,072 A	4/1967	Cue	3,884,008 A	5/1975	Miller
3,331,171 A	7/1967	Hallock	3,884,328 A	5/1975	Williams
3,331,176 A	7/1967	Washam	3,902,291 A	9/1975	Zucht
3,332,192 A	7/1967	Kessler et al.	3,902,293 A	9/1975	Witt et al.
3,339,329 A	9/1967	Berg	3,908,053 A	9/1975	Hettich
3,347,048 A	10/1967	Brown et al.	3,908,062 A	9/1975	Roberts
3,362,127 A	1/1968	McGowan	3,921,312 A	11/1975	Fuller
3,363,381 A	1/1968	Forrest	3,924,496 A	12/1975	DerMarderosian et al.
3,363,382 A	1/1968	Forrest	3,936,551 A	2/1976	Elmendorf et al.
3,363,383 A	1/1968	La Barge	3,936,758 A	2/1976	Kostelnicek et al.
3,373,071 A	3/1968	Fuerst	3,953,661 A	4/1976	Gulley
3,377,931 A	4/1968	Hilton	3,987,599 A	10/1976	Hines
3,385,182 A	5/1968	Harvey	3,988,187 A	10/1976	Witt et al.
3,387,422 A	6/1968	Wanzer	4,021,087 A	5/1977	Ferguson
3,397,496 A	8/1968	Sohns	4,037,377 A	7/1977	Howell et al.
3,444,660 A	5/1969	Feichter	4,059,933 A	11/1977	Funk et al.
3,449,879 A	6/1969	Bloom	4,060,437 A	11/1977	Strout
3,460,304 A	8/1969	Braeuninger et al.	4,065,902 A	1/1978	Lindal
3,473,278 A	10/1969	Gossen	4,067,155 A	1/1978	Ruff et al.
3,474,584 A	10/1969	Lynch	4,074,496 A	2/1978	Fischer
3,479,784 A	11/1969	Massagli	4,090,338 A	5/1978	Bourgade
3,481,810 A	12/1969	Waite	4,094,090 A	6/1978	Walmer
3,488,828 A	1/1970	Gallagher	4,095,913 A	6/1978	Pettersson et al.
3,496,119 A	2/1970	Fitzgerald	4,099,358 A	7/1978	Compaan
3,508,369 A	4/1970	Tennison	4,100,710 A	7/1978	Kowallik
3,512,324 A	5/1970	Reed	4,143,498 A	3/1979	Martin et al.
3,526,420 A	9/1970	Brancaleone	4,144,689 A	3/1979	Bains
3,535,844 A	10/1970	Glaros	4,150,517 A	4/1979	Warner
3,538,665 A	11/1970	Gohner	4,156,048 A	5/1979	Davis
3,538,819 A	11/1970	Gould et al.	4,158,335 A	6/1979	Belcastro
3,548,559 A	12/1970	Levine	4,164,832 A	8/1979	Van Zandt
3,553,919 A	1/1971	Omholt	4,165,305 A	8/1979	Sundie et al.
3,555,761 A	1/1971	Rosebrough	4,167,599 A	9/1979	Nissinen
3,555,762 A	1/1971	Costanzo, Jr.	4,169,688 A	10/1979	Toshio
3,570,205 A	3/1971	Payne	4,182,072 A	1/1980	Much
3,572,224 A	3/1971	Perry	4,186,539 A	2/1980	Harmon et al.
3,579,941 A	5/1971	Tibbals	4,196,554 A	4/1980	Anderson et al.
3,605,368 A	9/1971	Lalouche	4,198,455 A	4/1980	Spiro et al.
3,619,964 A	11/1971	Passaro et al.	4,226,064 A	10/1980	Kraayenhof
3,627,362 A	12/1971	Brenneman	4,242,390 A	12/1980	Nemeth
3,640,191 A	2/1972	Hendrich	4,247,390 A	1/1981	Knoll
3,657,852 A	4/1972	Worthington et al.	4,292,774 A	10/1981	Mairle
3,665,666 A	5/1972	Delcroix	4,299,070 A	11/1981	Oltmanns et al.
3,667,153 A	6/1972	Christensen	4,304,083 A	12/1981	Anderson
3,671,369 A	6/1972	Kvalheim et al.	4,316,351 A	2/1982	Ting
3,673,751 A	7/1972	Boassy et al.	4,372,899 A	2/1983	Wiemann et al.
3,676,971 A	7/1972	Dombroski	4,376,593 A	3/1983	Schaefer
3,679,531 A	7/1972	Wienand et al.	4,390,580 A	6/1983	Donovan et al.
3,687,773 A	8/1972	Wangborg	4,416,097 A	11/1983	Weir
3,694,983 A	10/1972	Couquet	4,426,820 A	1/1984	Terbrack et al.
3,696,575 A	10/1972	Armstrong	4,435,935 A	3/1984	Larrea
3,707,061 A	12/1972	Collette et al.	4,449,346 A	5/1984	Tremblay
3,714,747 A	2/1973	Curran	4,455,803 A	6/1984	Kornberger
			4,461,131 A	7/1984	Pressell
			4,471,012 A	9/1984	Maxwell
			4,489,115 A	12/1984	Layman et al.
			4,501,102 A	2/1985	Knowles

(56)

References Cited

U.S. PATENT DOCUMENTS

4,503,115 A	3/1985	Hemels et al.	5,165,816 A	11/1992	Parasin
4,504,347 A	3/1985	Munk et al.	5,179,811 A	1/1993	Walker et al.
4,505,887 A	3/1985	Miyata et al.	5,179,812 A	1/1993	Hill
4,512,131 A	4/1985	Laramore	5,182,892 A	2/1993	Chase
4,517,147 A	5/1985	Taylor et al.	5,215,802 A	6/1993	Kaars Sijpesteijn
4,520,062 A	5/1985	Ungar et al.	5,216,861 A	6/1993	Meyerson
4,538,392 A	9/1985	Hamar et al.	5,244,303 A	9/1993	Hair
4,561,233 A	12/1985	Harter et al.	5,247,773 A	9/1993	Weir
4,571,910 A	2/1986	Cosentino	5,253,464 A	10/1993	Nilsen
4,594,347 A	6/1986	Ishikawa et al.	5,259,162 A	11/1993	Nicholas
4,599,124 A	7/1986	Kelly et al.	5,266,384 A	11/1993	O'Dell et al.
4,599,841 A *	7/1986	Haid 52/396.04	5,271,564 A	12/1993	Smith
4,599,842 A	7/1986	Counihan	5,274,979 A	1/1994	Tsai
4,612,745 A	9/1986	Hovde	5,283,102 A	2/1994	Sweet et al.
4,621,471 A	11/1986	Kuhr et al.	5,292,155 A	3/1994	Bell et al.
4,640,437 A	2/1987	Weingartner	5,295,341 A	3/1994	Kajiware
4,641,469 A	2/1987	Wood	5,313,751 A	5/1994	Wittler
4,643,237 A	2/1987	Rosa	5,325,649 A	7/1994	Kajiware
4,646,494 A	3/1987	Saarinen et al.	5,343,665 A	9/1994	Palmersten
4,653,138 A	3/1987	Carder	5,344,700 A	9/1994	McGath et al.
4,653,242 A	3/1987	Ezard	5,348,778 A	9/1994	Knipp et al.
4,672,728 A	6/1987	Nimberger	5,349,796 A	9/1994	Meyerson
4,683,631 A	8/1987	Dobbertin	5,359,817 A	11/1994	Fulton
4,703,597 A	11/1987	Eggemar	5,365,713 A	11/1994	Nicholas et al.
4,715,162 A	12/1987	Brightwell	5,390,457 A	2/1995	Sjolander
4,724,187 A	2/1988	Ungar et al.	5,413,840 A	5/1995	Mizuno
4,733,510 A	3/1988	Werner	5,424,118 A	6/1995	McLaughlin
4,736,563 A	4/1988	Bilhorn	5,425,302 A	6/1995	Levrai et al.
4,738,071 A	4/1988	Ezard	5,433,048 A	7/1995	Strasser
4,741,136 A	5/1988	Thompson	5,433,806 A	7/1995	Pasquali et al.
4,747,197 A	5/1988	Charron	5,437,934 A	8/1995	Witt et al.
4,757,657 A	7/1988	Mitchell	5,474,831 A	12/1995	Nystrom
4,757,658 A	7/1988	Kaempfen	5,497,589 A	3/1996	Porter
4,766,443 A	8/1988	Winegard et al.	5,502,939 A	4/1996	Zadok et al.
4,769,963 A	9/1988	Meyerson	5,526,857 A	6/1996	Forman
4,796,402 A	1/1989	Pajala	5,527,128 A	6/1996	Rope et al.
4,806,435 A	2/1989	Athey	5,540,025 A	7/1996	Takehara et al.
4,819,532 A	4/1989	Benuzzi et al.	D373,203 S	8/1996	Kornfalt
4,819,932 A	4/1989	Trotter, Jr.	5,555,980 A	9/1996	Johnston et al.
4,831,806 A	5/1989	Niese et al.	5,566,519 A	10/1996	Almaraz-Miera
4,844,972 A	7/1989	Tedeschi et al.	5,567,497 A	10/1996	Zegler et al.
4,845,907 A	7/1989	Meek	5,570,554 A	11/1996	Searer
4,888,933 A	12/1989	Guomundsson et al.	5,581,967 A	12/1996	Glatz
4,893,449 A	1/1990	Kemper	5,597,024 A	1/1997	Bolyard et al.
4,894,272 A	1/1990	Aisley	5,618,602 A	4/1997	Nelson
4,905,442 A	3/1990	Daniels	5,618,612 A	4/1997	Gstrein
4,906,484 A	3/1990	Lambuth et al.	5,623,799 A	4/1997	Kowalski
4,910,280 A	3/1990	Robbins, III	5,630,304 A	5/1997	Austin
4,917,532 A	4/1990	Haberhauer et al.	5,647,181 A	7/1997	Hunts
4,920,626 A	5/1990	Nimberger	5,657,598 A	8/1997	Wilbs et al.
4,940,503 A	7/1990	Lindgren et al.	5,671,575 A	9/1997	Wu
4,952,775 A	8/1990	Yokoyama et al.	5,685,117 A	11/1997	Nicholson
4,953,335 A	9/1990	Kawaguchi et al.	5,688,569 A	11/1997	Gilmore et al.
4,988,131 A	1/1991	Wilson et al.	5,692,354 A	12/1997	Searer
4,998,395 A	3/1991	Bezner	5,695,875 A	12/1997	Larsson et al.
4,998,396 A	3/1991	Palmersten	5,706,621 A	1/1998	Pervan
5,003,016 A	3/1991	Boeder	5,706,623 A	1/1998	Brown
5,016,413 A	5/1991	Counihan	5,719,239 A	2/1998	Mirous et al.
5,029,425 A	7/1991	Bogataj	5,735,092 A	4/1998	Clayton et al.
5,034,272 A	7/1991	Lindgren et al.	5,736,227 A	4/1998	Sweet et al.
5,050,362 A	9/1991	Tal et al.	5,755,068 A	5/1998	Ormiston
5,052,158 A	10/1991	D'Luzansky	5,765,808 A	6/1998	Butschbacher et al.
5,058,333 A	10/1991	Schwartz	5,768,850 A	6/1998	Chen
5,070,662 A	12/1991	Niese	5,791,114 A	8/1998	Mandel
5,074,089 A	12/1991	Kemmer et al.	5,797,237 A	8/1998	Finkell, Jr.
5,086,599 A	2/1992	Meyerson	5,823,240 A	10/1998	Bolyard et al.
5,092,095 A	3/1992	Zadok	5,827,592 A	10/1998	Van Gulik et al.
5,102,253 A	4/1992	Conti	5,860,267 A	1/1999	Pervan
5,109,898 A	5/1992	Schacht	D406,360 S	3/1999	Finkell, Jr.
5,113,632 A	5/1992	Hanson	5,888,017 A	3/1999	Corrie
5,117,603 A	6/1992	Weintraub	5,894,701 A	4/1999	Delorme
5,138,812 A	8/1992	Palmersten	5,904,019 A	5/1999	Kooij et al.
5,148,850 A	9/1992	Urbanick	5,907,934 A	6/1999	Austin
5,155,952 A	10/1992	Herwegh et al.	5,930,947 A	8/1999	Eckhoff
5,157,890 A	10/1992	Jines	5,931,447 A	8/1999	Butschbacher et al.
			5,935,668 A	8/1999	Smith
			5,937,612 A	8/1999	Winer et al.
			5,941,047 A	8/1999	Johansson
			5,943,239 A	8/1999	Shamblin et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

5,945,181	A	8/1999	Fisher	6,588,165	B1	7/2003	Wright
5,950,389	A	9/1999	Porter	6,588,166	B2	7/2003	Martensson et al.
5,968,625	A	10/1999	Hudson	6,591,568	B1	7/2003	Palsson
5,971,655	A	10/1999	Shirakawa	6,601,359	B2	8/2003	Olofsson
5,987,839	A	11/1999	Hamar et al.	6,606,834	B2	8/2003	Martensson et al.
5,987,845	A	11/1999	Laronde	6,617,009	B1 *	9/2003	Chen et al. 428/195.1
5,996,301	A	12/1999	Conterno	6,647,689	B2	11/2003	Pletzer et al.
6,006,486	A	12/1999	Moriau et al.	6,647,690	B1 *	11/2003	Martensson 52/601
6,012,263	A	1/2000	Church et al.	6,670,019	B2	12/2003	Andersson
6,021,615	A	2/2000	Brown	6,672,030	B2	1/2004	Schulte
6,021,646	A	2/2000	Burley	6,681,820	B2	1/2004	Olofsson
6,023,907	A	2/2000	Pervan	6,682,254	B1	1/2004	Olofsson
6,029,416	A	2/2000	Andersson	6,685,391	B1	2/2004	Gideon
6,079,182	A	6/2000	Ellenberger	6,711,869	B2	3/2004	Tychsem
6,094,882	A	8/2000	Pervan	6,729,091	B1	5/2004	Martensson
6,098,365	A	8/2000	Martin et al.	6,745,534	B2	6/2004	Kornfalt
6,101,778	A	8/2000	Martensson	6,763,643	B1	7/2004	Martensson
6,106,654	A	8/2000	Velin et al.	6,769,217	B2 *	8/2004	Nelson 52/582.1
6,119,423	A	9/2000	Costantino	6,769,219	B2	8/2004	Schwitte et al.
6,122,879	A	9/2000	Montes	6,769,835	B2	8/2004	Stridsman
6,134,854	A	10/2000	Stanchfield	6,786,016	B1	9/2004	Wood
6,141,920	A	11/2000	Kemper	6,802,166	B1	10/2004	Gerhard
6,143,119	A	11/2000	Seidner	6,804,926	B1	10/2004	Eisermann
6,148,884	A	11/2000	Bolyard et al.	6,805,951	B2	10/2004	Kornfalt et al.
6,158,915	A	12/2000	Kise	6,851,237	B2	2/2005	Niese et al.
6,164,031	A	12/2000	Counihan	6,851,241	B2	2/2005	Pervan
6,182,410	B1	2/2001	Pervan	6,854,235	B2	2/2005	Martensson
6,182,413	B1	2/2001	Magnusson	6,860,074	B2	3/2005	Stanchfield
6,189,283	B1	2/2001	Bentley	6,862,857	B2	3/2005	Tychsen
6,205,639	B1	3/2001	Pervan	6,865,855	B2	3/2005	Knauseder
6,209,278	B1	4/2001	Tychsen	6,880,305	B2	4/2005	Pervan et al.
6,216,403	B1	4/2001	Belbeoc'h	6,880,307	B2	4/2005	Schwitte et al.
6,216,409	B1	4/2001	Roy et al.	6,898,913	B2	5/2005	Pervan
6,219,982	B1	4/2001	Eyring	6,918,220	B2	7/2005	Pervan
6,230,385	B1	5/2001	Nelson	6,920,732	B2	7/2005	Martensson
6,233,899	B1	5/2001	Mellert et al.	6,922,964	B2	8/2005	Pervan
6,247,285	B1	6/2001	Moebus	6,931,798	B1	8/2005	Pocai
6,253,514	B1	7/2001	Jobe et al.	6,966,161	B2	11/2005	Palsson et al.
6,271,156	B1	8/2001	Gleason et al.	RE38,950	E	1/2006	Maiers et al.
6,314,701	B1	11/2001	Meyerson	7,003,924	B2	2/2006	Kettler et al.
6,321,499	B1	11/2001	Chuang	7,015,727	B2	3/2006	Balasubramanian
6,324,796	B1	12/2001	Heath	7,021,019	B2	4/2006	Knauseder
6,324,803	B1	12/2001	Pervan	7,051,486	B2	5/2006	Pervan
6,324,809	B1	12/2001	Nelson	7,086,205	B2	8/2006	Pervan
6,332,733	B1	12/2001	Hamberger et al.	7,121,058	B2	10/2006	Palsson et al.
6,345,480	B1	2/2002	Kemper	7,121,059	B2	10/2006	Pervan
6,345,481	B1	2/2002	Nelson	7,131,242	B2	11/2006	Martensson
6,346,861	B2	2/2002	Kim et al.	7,146,772	B2	12/2006	Ralf
6,363,677	B1	4/2002	Chen et al.	7,152,507	B2	12/2006	Solari
6,363,678	B1	4/2002	Shuler	7,188,456	B2	3/2007	Knauseder
6,365,258	B1	4/2002	Alm	7,210,272	B2	5/2007	Friday
6,385,936	B1	5/2002	Schneider	7,251,916	B2	8/2007	Konzelmann et al.
6,397,547	B1	6/2002	Martensson	7,332,053	B2	2/2008	Palsson et al.
6,404,240	B1	6/2002	Hakkal et al.	7,337,588	B1	3/2008	Moebus
6,418,683	B1	7/2002	Martensson et al.	7,347,328	B2	3/2008	Hartwall
6,421,970	B1	7/2002	Martensson et al.	7,377,081	B2	5/2008	Ruhdorfer
6,423,257	B1	7/2002	Stobart	7,398,628	B2	7/2008	Van Horne
6,437,616	B1	8/2002	Antone et al.	7,441,385	B2	10/2008	Palsson et al.
6,438,919	B1	8/2002	Knauseder	7,444,791	B1	11/2008	Pervan
6,446,405	B1	9/2002	Pervan	7,451,578	B2	11/2008	Hannig
6,446,413	B1	9/2002	Gruber	7,484,337	B2	2/2009	Hecht
6,449,918	B1	9/2002	Nelson	7,497,058	B2	3/2009	Martensson
6,490,836	B1	12/2002	Moriau et al.	7,552,568	B2	6/2009	Palsson et al.
6,497,079	B1	12/2002	Pletzer et al.	7,603,826	B1	10/2009	Moebus
6,505,452	B1	1/2003	Hannig et al.	7,614,197	B2	11/2009	Nelson
6,510,665	B2	1/2003	Pervan	7,617,651	B2	11/2009	Grafenauer
6,516,579	B1	2/2003	Pervan	7,634,884	B2	12/2009	Pervan et al.
6,517,935	B1	2/2003	Kornfalt et al.	7,665,267	B2	2/2010	Moriau et al.
6,521,314	B2	2/2003	Tychsen	7,726,088	B2	6/2010	Muehlebach
6,526,719	B2	3/2003	Pletzer et al.	7,820,287	B2	10/2010	Kornfalt et al.
6,532,709	B2	3/2003	Pervan	7,841,144	B2	11/2010	Pervan
6,536,178	B1	3/2003	Palsson	7,856,784	B2	12/2010	Martensson
6,546,691	B2	4/2003	Leopolder	7,856,785	B2	12/2010	Pervan
6,550,205	B2	4/2003	Neuhofer	7,856,789	B2	12/2010	Eisermann
6,551,007	B2	4/2003	Lichtenberg et al.	7,877,956	B2	2/2011	Martensson
				7,896,571	B1	3/2011	Hannig et al.
				7,980,039	B2	7/2011	Groeke et al.
				7,980,043	B2	7/2011	Moebus
				8,006,458	B1	8/2011	Olofsson et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

8,028,486	B2	10/2011	Pervan et al.	2007/0028547	A1	2/2007	Grafenauer et al.
8,037,657	B2	10/2011	Sjoberg et al.	2007/0240376	A1	10/2007	Engstrom
8,038,363	B2	10/2011	Hannig et al.	2008/0000186	A1	1/2008	Pervan
8,117,795	B2	2/2012	Knauseder	2008/0134613	A1	6/2008	Pervan
8,146,318	B2	4/2012	Palsson	2008/0216434	A1	9/2008	Pervan
8,234,834	B2	8/2012	Martensson et al.	2008/0236088	A1	10/2008	Hannig
8,276,342	B2	10/2012	Martensson	2008/0271403	A1	11/2008	Palsson
8,402,709	B2	3/2013	Martensson	2009/0019806	A1	1/2009	Muehlebach
8,429,869	B2	4/2013	Pervan	2009/0019808	A1	1/2009	Palsson et al.
8,516,767	B2	8/2013	Engstrom	2009/0064624	A1	3/2009	Sokol
8,544,233	B2	10/2013	Palsson	2009/0100782	A1	4/2009	Groeke et al.
8,578,675	B2	11/2013	Palsson	2009/0193748	A1	8/2009	Boo et al.
8,615,952	B2	12/2013	Engstrom	2009/0199500	A1	8/2009	LeBlang
8,631,623	B2	1/2014	Engstrom	2009/0217615	A1	9/2009	Engstrom
8,661,762	B2	3/2014	Martensson et al.	2009/0249733	A1	10/2009	Moebus
8,720,148	B2	5/2014	Engstrom	2010/0031599	A1	2/2010	Kennedy et al.
8,789,334	B2	7/2014	Moriau et al.	2010/0043333	A1	2/2010	Hannig
8,875,465	B2	11/2014	Martensson	2010/0058700	A1	3/2010	LeBlang
8,978,334	B2	3/2015	Engstrom	2010/0236707	A1	9/2010	Studer et al.
9,032,685	B2	5/2015	Martensson et al.	2011/0078977	A1	4/2011	Martensson et al.
9,115,500	B2	8/2015	Engstrom	2011/0167751	A1	7/2011	Engstrom
9,140,009	B2	9/2015	Engstrom	2011/0173914	A1	7/2011	Engstrom
9,255,414	B2	2/2016	Palsson et al.	2011/0225922	A1	9/2011	Pervan et al.
9,260,869	B2	2/2016	Palsson et al.	2011/0271631	A1	11/2011	Engstrom
9,316,006	B2	4/2016	Palsson et al.	2011/0271632	A1	11/2011	Cappelle et al.
9,322,162	B2	4/2016	Olofsson et al.	2011/0293361	A1	12/2011	Olofsson
2001/0024707	A1	9/2001	Andersson et al.	2012/0042595	A1	2/2012	De Boe
2001/0029720	A1	10/2001	Pervan	2012/0055112	A1	3/2012	Engstrom
2002/0007608	A1	1/2002	Pervan	2012/0216472	A1	8/2012	Martensson et al.
2002/0046526	A1	4/2002	Knauseder	2012/0233948	A1	9/2012	Palsson
2002/0046528	A1	4/2002	Pervan et al.	2012/0247053	A1	10/2012	Martensson
2002/0095895	A1	7/2002	Daly et al.	2012/0291396	A1	11/2012	Martensson
2002/0112429	A1	8/2002	Niese et al.	2012/0304590	A1	12/2012	Engstrom
2002/0112433	A1	8/2002	Pervan	2013/0042555	A1	2/2013	Martensson
2002/0127374	A1	9/2002	Spratling	2013/0067840	A1	3/2013	Martensson
2002/0148551	A1	10/2002	Knauseder	2013/0241103	A1	9/2013	Engstrom
2002/0178674	A1	12/2002	Pervan	2013/0291467	A1	11/2013	Palsson et al.
2002/0178681	A1	12/2002	Zancai et al.	2014/0033630	A1	2/2014	Engstrom
2002/0178682	A1	12/2002	Pervan	2014/0137506	A1	5/2014	Palsson
2002/0189183	A1	12/2002	Ricciardelli	2014/0157711	A1	6/2014	Palsson et al.
2002/0189747	A1	12/2002	Steinwender	2014/0157721	A1	6/2014	Engstrom
2003/0009971	A1	1/2003	Palmberg	2014/0165493	A1	6/2014	Palsson et al.
2003/0009972	A1	1/2003	Pervan et al.	2014/0283476	A1	9/2014	Engstrom
2003/0024200	A1	2/2003	Moriau et al.	2015/0075105	A1	3/2015	Engstrom
2003/0084634	A1	5/2003	Stanchfield	2015/0184397	A1	7/2015	Engstrom
2003/0094230	A1	5/2003	Sjoberg	2016/0040438	A1	2/2016	Engstrom
2003/0112913	A1	6/2003	Balasubramanian	2016/0069087	A1	3/2016	Engstrom
2003/0118812	A1	6/2003	Kornfalt				
2003/0141004	A1	7/2003	Palmblad				
2003/0145540	A1	8/2003	Brunedal				
2003/0154678	A1	8/2003	Stanchfield				
2003/0159389	A1	8/2003	Kornfalt				
2003/0224147	A1	12/2003	Maine et al.				
2004/0016197	A1	1/2004	Ruhdorfer				
2004/0031225	A1	2/2004	Fowler				
2004/0031226	A1	2/2004	Miller				
2004/0031227	A1	2/2004	Knauseder				
2004/0035077	A1	2/2004	Martensson et al.				
2004/0040235	A1	3/2004	Kurtz				
2004/0041225	A1	3/2004	Nemoto				
2004/0139678	A1	7/2004	Pervan				
2004/0182036	A1	9/2004	Sjoberg et al.				
2004/0191461	A1	9/2004	Riccobene				
2004/0211143	A1	10/2004	Hanning				
2004/0211144	A1	10/2004	Stanchfield				
2004/0250492	A1	12/2004	Becker				
2005/0034405	A1	2/2005	Pervan				
2005/0144881	A1	7/2005	Tate				
2005/0166526	A1	8/2005	Stanchfield				
2005/0210810	A1	9/2005	Pervan				
2005/0252130	A1	11/2005	Martensson				
2006/0101769	A1	5/2006	Pervan				
2006/0236642	A1	10/2006	Pervan				
2006/0248836	A1	11/2006	Martensson				
2007/0006543	A1	1/2007	Engstrom				

FOREIGN PATENT DOCUMENTS

AU	1 309 883	A	10/1983
AU	199 732 569	B2	6/1997
AU	200 020 703	C	6/2000
BE	417 526	A	10/1936
BE	556 860	A	5/1957
BE	557 844	A	3/1960
BE	765 817	A2	9/1971
BE	1 010 339	A3	6/1998
BE	1 010 487	A6	10/1998
CA	991 373	A1	6/1976
CA	1 049 736	A1	3/1979
CA	1 169 106	A1	6/1984
CA	1 325 873	C	1/1994
CA	2 226 286	A1	12/1997
CA	2 252 791	C	5/1999
CA	2 162 836	C	6/1999
CA	2 289 309	A1	11/1999
CA	2 150 384	C	4/2005
CH	200 949	A	11/1938
CH	211 677	A	10/1940
CH	211 877	A	10/1940
CH	562 377	A5	5/1975
CH	640 455	A5	1/1984
CN	1 054 215	A	9/1991
CN	2 091 909	U	1/1992
CN	1 115 351	A	1/1996
CN	1 124 941	A	6/1996
CN	2 242 278	Y	12/1996
DE	2 09 979	C	11/1906

(56)

References Cited

FOREIGN PATENT DOCUMENTS

DE	5 17 353	2/1931	DE	199 33 343	A1	2/2001
DE	12 12 275 B	3/1966	DE	200 17 461		2/2001
DE	19 34 295 U	3/1966	DE	200 27 461		3/2001
DE	19 85 418 U	5/1968	DE	199 63 203	A1	9/2001
DE	15 34 802 A1	4/1970	DE	100 01 076		10/2001
DE	71 02 476	6/1971	DE	202 03 311	U1	5/2002
DE	16 58 875 B1	9/1971	DE	100 62 873		7/2002
DE	20 07 129 A1	9/1971	DE	202 06 751	U1	8/2002
DE	15 34 278 A1	11/1971	DE	101 20 062	A1	11/2002
DE	21 39 283 A1	2/1972	DE	101 31 248		1/2003
DE	21 01 782 A1	7/1972	DE	102 42 647	A1	6/2004
DE	21 02 537 A1	8/1972	DE	10 2004 055 951	A1	7/2005
DE	21 45 024 A1	3/1973	DE	10 2005 002 297.9		8/2005
DE	21 59 042 A1	6/1973	DE	10 2007 035 648		1/2009
DE	22 05 232 A1	8/1973	DE	20 2009 004 530		6/2009
DE	22 38 660 A1	2/1974	DE	10 2010 020 089.1		5/2010
DE	22 51 762	5/1974	DE	10 2009 022 483	A1	12/2010
DE	22 52 643 A1	5/1974	DE	10 2009 038 750		3/2011
DE	74 02 354	5/1974	DE	10 201 004717.1		7/2011
DE	25 02 992 A1	7/1976	DE	20 2004 021 867		12/2011
DE	25 52 622 A1	5/1977	EP	0 024 360	A1	3/1981
DE	26 16 077 A1	10/1977	EP	0 044 371	A1	1/1982
DE	28 02 151 A1	7/1979	EP	0 085 196		8/1983
DE	29 17 025 A1	11/1980	EP	0 117 707	A2	9/1984
DE	29 16 482 A1	12/1980	EP	0 161 233	A1	11/1985
DE	29 27 425 A1	1/1981	EP	0 196 672	A2	10/1986
DE	31 04 519	2/1981	EP	0 220 389	A2	5/1987
DE	29 40 945 A1	4/1981	EP	0 248 127		12/1987
DE	30 41 781 A1	6/1982	EP	0 256 189	A1	2/1988
DE	30 46 618 A1	7/1982	EP	0 279 278	A2	8/1988
DE	31 17 605 A1	11/1982	EP	0 335 778	A2	10/1989
DE	32 14 207	11/1982	EP	0 401 146	A1	12/1990
DE	32 46 376	6/1984	EP	0 487 925	A1	6/1992
DE	33 04 992	8/1984	EP	0 508 083	A1	10/1992
DE	33 06 609	9/1984	EP	0 508 260	A2	10/1992
DE	33 19 235	11/1984	EP	0 562 402	A1	9/1993
DE	33 43 601	6/1985	EP	0 604 896	A1	7/1994
DE	34 12 882 A1	10/1985	EP	0 623 724		11/1994
DE	86 00 241 U1	4/1986	EP	0 652 332	A1	5/1995
DE	86 04 004	4/1986	EP	0 652 340		5/1995
DE	35 12 204	10/1986	EP	0 690 185	A1	1/1996
DE	35 44 845	6/1987	EP	0 698 162		2/1996
DE	36 31 390	12/1987	EP	0 711 886		5/1996
DE	36 40 822	6/1988	EP	0 715 037	A1	6/1996
DE	37 41 041 A1	9/1988	EP	0 799 679	A2	10/1997
DE	39 33 611 A1	4/1991	EP	0 813 641	A1	12/1997
DE	41 05 207 A1	8/1991	EP	0 843 763		5/1998
DE	40025470	8/1991	EP	0 849 416		6/1998
DE	39 32 980	11/1991	EP	0 85 5482		7/1998
DE	41 30 115 A1	3/1993	EP	0 877 130		11/1998
DE	93 00 306	3/1993	EP	0 903 451		3/1999
DE	41 34 452	4/1993	EP	0 906 994	A1	4/1999
DE	42 15 273	11/1993	EP	0 958 441		11/1999
DE	42 42 530	6/1994	EP	0 969 163		1/2000
DE	43 44 089	7/1994	EP	0 969 164		1/2000
DE	43 13 037 C1	8/1994	EP	0 974 713		1/2000
DE	93 17 191	3/1995	EP	1 045 083	A1	10/2000
DE	44 02 352 A1	8/1995	EP	1 120 515	A1	8/2001
DE	195 03 948 A1	8/1996	EP	1 146 182	A2	10/2001
DE	295 20 966 U1	8/1996	EP	1 229 181		8/2002
DE	29614 086	10/1996	EP	1 262 608	A2	12/2002
DE	196 01 322 A1	5/1997	EP	1 279 778	A2	1/2003
DE	297 03 962	6/1997	EP	1 308 577	A2	5/2003
DE	29710175	8/1997	EP	1 350 904	A2	10/2003
DE	29711960	10/1997	EP	1 359 266	A2	11/2003
DE	196 51 149	6/1998	EP	1 367 194	A2	12/2003
DE	197 04 292 A1	8/1998	EP	1 420 125	A2	5/2004
DE	197 09 641	9/1998	EP	1 437 457	A2	7/2004
DE	197 18 319 A1	11/1998	EP	2 400 076		8/2004
DE	198 21 938 A1	11/1999	EP	2 034 106		3/2009
DE	198 51 200 C1	3/2000	FI	843060	A	8/1984
DE	200 01 225	7/2000	FR	557844	A	8/1923
DE	199 40 837 A1	11/2000	FR	1175582	A	3/1959
DE	199 25 248	12/2000	FR	1215852	A	4/1960
DE	200 18 284	1/2001	FR	1293043		5/1962
			FR	1372596	A	9/1964
			FR	1511292	A	1/1968
			FR	2209024	A1	6/1974
			FR	2268922	A1	11/1975

(56)

References Cited

FOREIGN PATENT DOCUMENTS

FR	2278876	A1	2/1976	JP	4106264		4/1992
FR	2345560	A1	10/1977	JP	4191001		7/1992
FR	2362254	A1	3/1978	JP	H 04191001	A	7/1992
FR	2416988	A1	9/1979	JP	04261955	A	9/1992
FR	2445874	A1	8/1980	JP	H 0518028	A	1/1993
FR	2568295		1/1986	JP	5148984		6/1993
FR	2630149		10/1989	JP	6146553		5/1994
FR	2637932		4/1990	JP	6200611	A	7/1994
FR	2675174		10/1992	JP	H 0656310	U	8/1994
FR	2691491		11/1993	JP	6315944	A	11/1994
FR	2691691		12/1993	JP	6320510		11/1994
FR	2697275		4/1994	JP	407052103		2/1995
FR	2712329		5/1995	JP	H 0 752103	A	2/1995
FR	2781513		1/2000	JP	70769823		3/1995
FR	2785633		5/2000	JP	7180333		7/1995
FR	2810060		12/2001	JP	7189466	A	7/1995
FR	2891491	A1	4/2007	JP	7229276		8/1995
GB	240629	A	10/1925	JP	H 07229276	A	8/1995
GB	356270	A	9/1931	JP	7279366		10/1995
GB	424057		2/1935	JP	H 07279366	A	10/1995
GB	448329	A	6/1936	JP	7300979		11/1995
GB	471438	A	9/1937	JP	7310426		11/1995
GB	585205		1/1947	JP	961207		2/1996
GB	589635	A	6/1947	JP	H 0874405	A	3/1996
GB	599793		3/1948	JP	8086078		4/1996
GB	636423		4/1950	JP	8109734	A	4/1996
GB	647812	A	12/1950	JP	H 0886078	A	4/1996
GB	812671		4/1959	JP	8270193	A	10/1996
GB	875327	A	8/1961	JP	H 08268344	A	10/1996
GB	1027709	A	4/1966	JP	H 0938906	A	2/1997
GB	1039949	A	8/1966	JP	H 0988315	A	3/1997
GB	1127915	A	9/1968	JP	H 09256603	A	9/1997
GB	1161838	A	8/1969	JP	10219975	A	8/1998
GB	1171337	A	11/1969	JP	5154806	B2	8/2008
GB	1183401	A	3/1970	JP	4203141	B2	12/2008
GB	1191656	A	5/1970	JP	5304714	B2	10/2013
GB	1212983		11/1970	KR	9533446	A	12/1995
GB	1237744		6/1971	NL	7601773		2/1975
GB	1275511	A	5/1972	NO	157871		7/1984
GB	1308011	A	2/1973	NO	305614		5/1995
GB	1348272		3/1974	PL	26931	U1	6/1989
GB	1430423		3/1976	SE	372 051		12/1974
GB	1445687	A	8/1976	SE	7114900-9		12/1974
GB	1485419	A	9/1977	SE	7706470		12/1978
GB	2117813		10/1983	SE	450 141		6/1987
GB	2124672	A	2/1984	SE	8206934-5		6/1987
GB	2126106		3/1984	SE	457 737		7/1989
GB	2142670		1/1985	SE	462 809		4/1990
GB	2168732		6/1986	SE	467 150		6/1992
GB	2167465		1/1989	SE	501 014		10/1994
GB	2221740	A	2/1990	SE	9301595-6		10/1994
GB	222753		9/1990	SE	9500810		3/1995
GB	2240039	A	7/1991	SE	502 994		3/1996
GB	2243381		10/1991	SE	503 861		9/1996
GB	2256023		11/1992	SE	509 059		11/1998
GB	2325342	A	11/1998	SE	509 060		11/1998
GB	2365880	A	2/2002	SE	512 290		2/2000
IT	444123		1/1949	SE	512 313		2/2000
IT	812671		4/1959	SE	513 189	C2	7/2000
JP	5465528		5/1979	SE	514 645	C2	3/2001
JP	57119056		7/1982	SE	0001149		10/2001
JP	59041560	A	3/1984	SU	363795	A1	1/1973
JP	59186336		12/1984	SU	857393	A1	8/1981
JP	S6414838	A	1/1989	WO	WO 80/02155		10/1980
JP	S6414839	U	1/1989	WO	WO 82/00313	A1	2/1982
JP	1178659		7/1989	WO	WO 84/02155	A1	6/1984
JP	H 01178659	A	7/1989	WO	WO 87/03839		7/1987
JP	H 02285145	A	11/1990	WO	WO 90/00656	A1	1/1990
JP	H 03318343	U	2/1991	WO	WO 92/12074	A2	7/1992
JP	3046645		4/1991	WO	WO 92/17657		10/1992
JP	H 0344645		4/1991	WO	WO 93/13280		7/1993
JP	3110258		5/1991	WO	WO 93/19910	A1	10/1993
JP	H 03110258	A	5/1991	WO	WO 94/01628		1/1994
JP	3169967		7/1991	WO	WO 94/04773	A1	3/1994
JP	3202550		9/1991	WO	WO 94/22678	A1	10/1994
				WO	WO 94/26999	A1	11/1994
				WO	WO 95/05274	A1	3/1995
				WO	WO 95/06176	A1	3/1995
				WO	WO 95/14834	A1	6/1995

(56)

References Cited

FOREIGN PATENT DOCUMENTS

WO	WO 96/12857	5/1996
WO	WO 96/23942	8/1996
WO	WO 96/27719	9/1996
WO	WO 96/27721	9/1996
WO	WO 96/30177	10/1996
WO	WO 97/47834 A1	12/1997
WO	WO 98/22677 A1	5/1998
WO	WO 98/22678	5/1998
WO	WO 98/24994	6/1998
WO	WO 98/24995	6/1998
WO	WO 98/58142	12/1998
WO	WO 99/01628	1/1999
WO	WO 99/13179 A1	3/1999
WO	WO 99/40273	8/1999
WO	WO 99/66151	12/1999
WO	WO 99/66152	12/1999
WO	WO 00/06854	2/2000
WO	WO 00/20705 A1	4/2000
WO	WO 00/20706 A1	4/2000
WO	WO 00/47841 A1	8/2000
WO	WO 00/56802	9/2000
WO	WO 00/63510	10/2000
WO	WO 00/66856	11/2000
WO	WO 01/02669	1/2001
WO	WO 01/02670 A1	1/2001
WO	WO 01/02671 A1	1/2001
WO	WO 01/02672 A1	1/2001
WO	WO 01/07729 A1	2/2001
WO	WO 00/02214	3/2001
WO	WO 01/20101	3/2001
WO	WO 01/31141	5/2001
WO	WO 01/48332 A1	7/2001
WO	WO 01/51732 A1	7/2001
WO	WO 01/51733	7/2001
WO	WO 01/53628 A1	7/2001
WO	WO 01/66877 A1	9/2001
WO	WO 01/75247 A1	10/2001
WO	WO 01/77461 A1	10/2001
WO	WO 01/88306 A1	11/2001
WO	WO 01/88307 A1	11/2001
WO	WO 01/96688 A1	12/2001
WO	WO 01/98604 A1	12/2001
WO	WO 02/055809 A1	7/2002
WO	WO 02/055810 A1	7/2002
WO	WO 2007/089186 A1	8/2002
WO	WO 02/081843	10/2002
WO	WO 03/012224 A1	2/2003
WO	WO 03/016654 A1	2/2003
WO	WO 03/025307 A1	3/2003
WO	WO 03/074814 A1	9/2003
WO	WO 03/078761 A1	9/2003
WO	WO 03/083234 A1	10/2003
WO	WO 03/087497 A1	10/2003
WO	WO 03/089736 A1	10/2003
WO	WO 03/093686	11/2003
WO	WO 2004/016877 A1	2/2004
WO	WO 2004/020764 A1	3/2004
WO	WO 2004/081316 A1	9/2004
WO	WO 2004/085765 A1	10/2004
WO	WO 2005/040521 A2	5/2005
WO	WO 2005/054599 A1	6/2005
WO	WO 2005/059269	6/2005
WO	WO 2006/043893 A1	4/2006
WO	WO 2006/104436 A1	10/2006
WO	WO 2007/008139	1/2007
WO	WO 2007/141605 A2	12/2007
WO	WO 2008/004960	1/2008
WO	WO 2008/068245	6/2008
WO	WO 2009/066153	5/2009
WO	WO 2009/116926 A1	9/2009
WO	WO 2009/139687 A1	11/2009
WO	WO 2010/082171 A2	7/2010
WO	WO 2010/108980 A1	9/2010
WO	WO 2010/136171 A1	12/2010
WO	WO 2011/085788 A1	7/2011

WO	WO 2011/085825 A1	7/2011
WO	WO 2011/087425 A1	7/2011
WO	WO 2011/096879 A1	8/2011
WO	WO 2011/141043 A1	11/2011

OTHER PUBLICATIONS

Traditional Details; For Building Restoration, Renovation, and Rehabilitation: From the 1932-1951 Editions of Architectural Graphic Standards; John Wiley & Sons, Inc.

Trainindustrins Handbook "Snickeriarbete", Knut Larsson, Tekno's Handbocker Publikation 12-11 (1952).

Elements of Rolling Practice; The United Steel Companies Limited Sheffield, England, 1963; pp. 116-117.

Die mobile; Terbrack; 1968.

High-Production Roll Forming; Society of Manufacturing Engineers Marketing Services Depmiment; pp. 189-192; George T. Halmos; 1983.

Fundamentals of Building Construction Materials and Methods; Copyright 1985; pp. 11. cited by other. Automated Program of Designing Snap-fits; Aug. 1987; pp. 3.

Automated Program of Designing Snap-fits; Aug. 1987; pp. 3.

Plastic Part Technology; 1991; pp. 161-162.

Technoscope; Modern Plastics, Aug. 1991; pp. 29-30.

Encyclopedia of Wood Joints; A Fine Woodworking Book; pp. 1-151; 1992.

Whittington's Dictionary of Plastics; Edited by James F. Carley, Ph.D., PE; pp. 443, 461; 1993.

Patent Abstract of Japan, Publication No. 07300979, Konishi et al, Nov. 1995.

Patent Mit Inter-nationalem, Die Revolution ((von Grund auf)) Fibro-Trespo, Distributed at the Domotex fair in Hannover, Germany, Jan. 1996.

International Search Report for PCT/SE 96/00256 dated Jun. 26, 1996.

Wood Handbook; Forest Products Laboratory, 1999; "Glossary pp. G-1 to 0-14", "Chapter 10, pp. 10-1 to 10-31".

U.S. Appl. No. 90/637,036, filed Oct. 2000, Pervan.

Focus, Information Till Ana Medabetare, Jan. 2001, Kahrs pa Domotex I Hmmove, Tysklm1d, Jan. 13-16, 2001.

Search Report dated Apr. 21, 2001.

Letter to the USPTO dated May 14, 2002, regarding U.S. Appl. No. 90/005,744.

Non-Final Office Action for U.S. Appl. No. 10/270,163 dated Dec. 10, 2004.

Final Office Action for U.S. Appl. No. 10/270,163 dated Jun. 2, 2005.

Non-Final Office Action for U.S. Appl. No. 10/015,741 dated Jun. 29, 2005.

Advisory Action for U.S. Appl. No. 10/270,163 dated Sep. 15, 2005.

Notice of Allowance for U.S. Appl. No. 10/015,741 dated Dec. 1, 2005.

Non-Final Office Action for U.S. Appl. No. 10/270,163 dated Dec. 14, 2005.

Final Office Action for U.S. Appl. No. 10/270,163 dated May 25, 2006.

Advisory Action for U.S. Appl. No. 10/270,163 dated Aug. 8, 2006.

Non-Final Office Action for U.S. Appl. No. 11/185,724 dated Sep. 26, 2006.

Non-Final Office Action for U.S. Appl. No. 11/483,636 dated Oct. 11, 2006.

Reexamination U.S. Appl. No. 90/007,366 dated Oct. 24, 2006.

Reexamination U.S. Appl. No. 90/007,526 dated Dec. 5, 2006.

International Search Report for Application No. PCT/SE2007/000070 dated Mar. 29, 2007.

Non-Final Office Action for U.S. Appl. No. 11/185,724 dated Apr. 19, 2007.

Non-Final Office Action for U.S. Appl. No. 11/483,636 dated Apr. 19, 2007.

Non-Final Office Action for U.S. Appl. No. 11/015,741 dated Sep. 6, 2007.

(56)

References Cited**OTHER PUBLICATIONS**

Non-Final Office Action for U.S. Appl. No. 11/242,127 dated Nov. 1, 2007.
 Non-Final Office Action for U.S. Appl. No. 11/185,724 dated Jan. 9, 2008.
 Final Office Action for U.S. Appl. No. 11/015,741 dated Feb. 26, 2008.
 Non-Final Office Action for U.S. Appl. No. 11/483,636 dated Apr. 3, 2008.
 Non-Final Office Action for U.S. Appl. No. 11/242,127 dated Apr. 29, 2008.
 United States District Court Eastern District of Wisconsin; Order; Dated May 1, 2008.
 Examiner Interview Summary for U.S. Appl. No. 11/015,741 dated May 7, 2008.
 Restriction Requirement for U.S. Appl. No. 10/580,191 dated May 12, 2008.
 Final Office Action for U.S. Appl. No. 11/185,724 dated Jul. 9, 2008.
 Non-Final Office Action for U.S. Appl. No. 10/580,191 dated Jul. 16, 2008.
 Reexamination U.S. Appl. No. 90/007,365 dated Aug. 5, 2008.
 United States District Court Eastern District of Wisconsin; Judgment; Dated Oct. 10, 2008.
 United States District Court Eastern District of Wisconsin; Order; Dated Oct. 10, 2008.
 Final Office Action for U.S. Appl. No. 11/483,636 dated Nov. 20, 2008.
 Restriction Requirement for U.S. Appl. No. 11/242,127 dated Dec. 8, 2008.
 United States District Court Eastern District of Wisconsin; Order; Dated Dec. 31, 2008.
 Non-Final Office Action for U.S. Appl. No. 11/242,127 dated Mar. 31, 2009.
 Restriction Requirement for U.S. Appl. No. 12/010,587 dated Apr. 27, 2009.
 Non-Final Office Action for U.S. Appl. No. 12/010,587 dated Jun. 23, 2009.
 Non-Final Office Action for U.S. Appl. No. 11/483,636 dated Jul. 21, 2009.
 Examiner Interview Summary for U.S. Appl. No. 11/185,724 dated Aug. 13, 2009.
 Non-Final Office Action for U.S. Appl. No. 12/278,274 dated Sep. 24, 2009.
 Final Office Action for U.S. Appl. No. 11/242,127 dated Nov. 24, 2009.
 Restriction Requirement for U.S. Appl. No. 12/010,587 dated Jan. 20, 2010.
 United States Court of Appeals for Federal Circuit; 2009-1107,-1122; Decided: Feb. 18, 2010.
 Appeals from the United States District Court for the Eastern District of Wisconsin; Consolidated case No. 02-CV-0736 0736 and 03-CV-616; Judge J.P. Stadtmueller, 2009-1107,-1122. Revised Feb. 25, 2010.
 Non-Final Office Action for U.S. Appl. No. 10/580,191 dated Mar. 10, 2010.
 Non-Final Office Action for U.S. Appl. No. 11/483,636 dated Mar. 17, 2010.
 Advisory Action for U.S. Appl. No. 11/242,127 dated Mar. 18, 2010.
 United States Court of Appeals of the Federal Circuit; Case No. 02-CV-0736 and 03-CV-616; Mandate issued on Apr. 12, 2010; Judgment; 2 pages.
 Final Office Action for U.S. Appl. No. 12/278,274 dated May 17, 2010.
 Final Office Action for U.S. Appl. No. 12/010,587 dated May 25, 2010.
 Advisory Action for U.S. Appl. No. 12/010,587 dated Sep. 13, 2010.
 Advisory Action for U.S. Appl. No. 12/278,274 dated Sep. 27, 2010.

Final Office Action for U.S. Appl. No. 10/580,191 dated Oct. 6, 2010.
 Non-Final Office Action for U.S. Appl. No. 12/278,274 dated Nov. 2, 2010.
 Non-Final Office Action for U.S. Appl. No. 11/483,636 dated Dec. 7, 2010.
 Advisory Action for U.S. Appl. No. 10/580,191 dated Feb. 15, 2011.
 Non-Final Office Action for U.S. Appl. No. 12/010,587 dated Mar. 16, 2011.
 International Search Report for Application No. PCT/EP2010/006772 dated Mar. 31, 2011.
 Final Office Action for U.S. Appl. No. 12/278,274 dated Apr. 14, 2011.
 Final Office Action for U.S. Appl. No. 11/483,636 dated May 24, 2011.
 Non-Final Office Action for U.S. Appl. No. 13/048,646 dated May 25, 2011.
 Non-Final Office Action for U.S. Appl. No. 12/966,861 dated Jul. 20, 2011.
 Non-Final Office Action for U.S. Appl. No. 12/979,086 dated Aug. 3, 2011.
 Non-Final Office Action for U.S. Appl. No. 12/010,587 dated Aug. 30, 2011.
 Non-Final Office Action for U.S. Appl. No. 11/483,636 dated Sep. 28, 2011.
 Non-Final Office Action for U.S. Appl. No. 12/240,739 dated Oct. 5, 2011.
 Decision revoking the European Patent EP-B-1 276 941 dated Oct. 21, 2011.
 European Patent Office Opposition Division Decision for Application No. 01906461.7 dated Oct. 21, 2011.
 Final Office Action for U.S. Appl. No. 13/048,646 dated Nov. 1, 2011.
 Final Office Action for U.S. Appl. No. 12/966,861 dated Jan. 20, 2012.
 Final Office Action for U.S. Appl. No. 12/979,086 dated Jan. 25, 2012.
 Restriction Requirement for U.S. Appl. No. 12/966,797 dated Jan. 31, 2012.
 Notice of Allowance for U.S. Appl. No. 12/240,739 dated Feb. 2, 2012.
 Final Office Action for U.S. Appl. No. 11/483,636 dated Feb. 7, 2012.
 Non-Final Office Action for U.S. Appl. No. 12/966,797 dated Feb. 29, 2012.
 Final Office Action for U.S. Appl. No. 13/204,481 dated Mar. 12, 2012.
 Abandoned United States U.S. Appl. No. 13/420,282, filed Mar. 14, 2012.
 Final Office Action for U.S. Appl. No. 12/010,587 dated Mar. 22, 2012.
 Notice of Allowance for U.S. Appl. No. 12/966,861 dated Apr. 11, 2012.
 Advisory Action for U.S. Appl. No. 13/204,481 dated May 24, 2012.
 Advisory Action for U.S. Appl. No. 12/010,587 dated May 30, 2012.
 Non-Final Office Action for U.S. Appl. No. 13/437,597 dated Jul. 9, 2012.
 Restriction Requirement for U.S. Appl. No. 13/452,183 dated Jul. 10, 2012.
 Notice of Allowance for U.S. Appl. No. 12/979,086 dated Jul. 19, 2012.
 Non-final Office Action for U.S. Appl. No. 12/747,454 dated Aug. 6, 2012.
 Final Office Action for U.S. Appl. No. 12/966,797 dated Aug. 8, 2012.
 Non-Final Office Action for U.S. Appl. No. 13/452,183 dated Aug. 8, 2012.
 Non-Final Office Action for U.S. Appl. No. 13/204,481 dated Sep. 7, 2012.
 Non-Final Office Action for U.S. Appl. No. 13/567,933 dated Sep. 12, 2012.

(56)

References Cited

OTHER PUBLICATIONS

- Non-Final Office Action for U.S. Appl. No. 12/010,587 dated Oct. 10, 2012.
- Non-Final Office Action for U.S. Appl. No. 11/483,636 dated Oct. 10, 2012.
- Advisory Action for U.S. Appl. No. 12/966,797 dated Oct. 18, 2012.
- European Office Action dated Oct. 19, 2012.
- Notice of Allowance for U.S. Appl. No. 13/437,597 dated Oct. 26, 2012.
- Non-Final Office Action for U.S. Appl. No. 13/086,931 dated Nov. 7, 2012.
- Non-Final Office Action for U.S. Appl. No. 13/492,512 dated Nov. 21, 2012.
- Non-Final Office Action for U.S. Appl. No. 13/463,329 dated Nov. 21, 2012.
- Notice of Allowance for U.S. Appl. No. 11/483,636 dated Nov. 23, 2012.
- Notice of Allowance for U.S. Appl. No. 10/270,163 dated Dec. 13, 2012.
- Non-Final Office Action for U.S. Appl. No. 12/966,797 dated Dec. 13, 2012.
- Non-Final Office Action for U.S. Appl. No. 13/559,230 dated Dec. 20, 2012.
- Non-Final Office Action for U.S. Appl. No. 13/675,936 dated Dec. 31, 2012.
- Notice of Allowability for U.S. Appl. No. 11/483,636 dated Jan. 3, 2013.
- Notice of Allowance for U.S. Appl. No. 12/747,454 dated Jan. 8, 2013.
- Notice of Allowance for U.S. Appl. No. 13/437,597 dated Jan. 9, 2013.
- Final Office Action for U.S. Appl. No. 12/010,587 dated Jan. 28, 2013.
- Non-Final Office Action for U.S. Appl. No. 13/620,098 dated Feb. 8, 2013.
- Final Office Action for U.S. Appl. No. 13/204,481 dated Feb. 25, 2013.
- Non-Final Office Action for U.S. Appl. No. 13/492,512 dated Feb. 26, 2013.
- Non-Final Office Action for U.S. Appl. No. 11/015,741 dated Mar. 13, 2013.
- Final Office Action for U.S. Appl. No. 13/567,933 dated Mar. 15, 2013.
- Notice of Allowance for U.S. Appl. No. 11/242,127 dated Apr. 26, 2013.
- Notice of Allowance for U.S. Appl. No. 13/437,597 dated Apr. 29, 2013.
- Non-Final Office Action for U.S. Appl. No. 12/747,454 dated May 10, 2013.
- Notice of Allowance for U.S. Appl. No. 11/185,724 dated May 20, 2013.
- Non-Final Office Action for U.S. Appl. No. 13/559,242 dated Jun. 7, 2013.
- Applicant-Initiated Interview Summary for U.S. Appl. No. 13/204,481 dated Jul. 29, 2013.
- Corrected Notice of Allowability for U.S. Appl. No. 11/185,724 dated Aug. 1, 2013.
- Final Office Action for U.S. Appl. No. 13/086,931 dated Aug. 5, 2013.
- Notice of Allowance for U.S. Appl. No. 12/966,797 dated Aug. 7, 2013.
- Notice of Allowance for U.S. Appl. No. 12/010,587 dated Aug. 14, 2013.
- Notice of Allowance for U.S. Appl. No. 13/559,230 dated Aug. 20, 2013.
- Non-Final Office Action for U.S. Appl. No. 13/860,315 dated Aug. 26, 2013.
- Notice of Allowance for U.S. Appl. No. 11/185,724 dated Sep. 3, 2013.
- Non-Final Office Action for U.S. Appl. No. 13/204,481 dated Sep. 4, 2013.
- Final Office Action for U.S. Appl. No. 13/620,098 dated Sep. 24, 2013.
- Non-Final Office Action for U.S. Appl. No. 13/463,329 dated Sep. 25, 2013.
- Notice of Allowance for U.S. Appl. No. 13/675,936 dated Sep. 25, 2013.
- Supplemental Notice of Allowance for U.S. Appl. No. 12/966,797 dated Oct. 3, 2013.
- Supplemental Notice of Allowance for U.S. Appl. No. 13/559,230 dated Oct. 4, 2013.
- Notice of Allowance for U.S. Appl. No. 11/185,724 dated Nov. 1, 2013.
- Final Office Action for U.S. Appl. No. 12/747,454 dated Nov. 6, 2013.
- Restriction Requirement for U.S. Appl. No. 13/957,971 dated Nov. 12, 2013.
- Notice of Allowance for U.S. Appl. No. 13/086,931 dated Nov. 19, 2013.
- Notice of Allowance for U.S. Appl. No. 12/966,797 dated Dec. 5, 2013.
- Architectural Graphic Standards; John Wiley & Sons, Inc.
- Bojlesystemet til Junckers boliggulve, Junckers Trae for Livet.
- CLIC, Ali-Nr, 110 11 640.
- Fibolic Brochure, undated.
- Fiboloc Literature, Mar. 1999.
- FN Neuhofer Holz, "Profiles in various kinds and innovative accessories"; Certified according to DIN EN ISO 9002.
- Haro Wand and Decke.
- Hot Rolling of Steel; Library of Congress Cataloging in Publication Data; Roberts, William L; p. 189.
- Laminat-Boden, Clever-Clickq.
- New Software Simplifies Snap-Fit Design; Design News; p. 148.
- Opplaering OG Autorisasjon, Fibro-Trespo, ALLOC, Lmminatgulvet som Legges Uter Lin.
- Original Pergo the Free and Easy Floor.
- Pergo, Clic Flooring, Laminatgolv.
- Plastic Product Design; Van Nostrand Reinhold Company; pp. 256-258.
- Special Verdict, Civil Case No. 02-C-0736.
- The Clip System for Junckers Sports Floors, Junckers Solid Hardwood Flooring, Almex 7, p. 1/2.
- The Clip System for Junckers Sports Floors, Junckers Solid Hardwood Flooring, Annex 8, p. 1/4.
- Time Life Books; "Floors, Stairs, Carpets," p. 14.
- Trabearbetning Anders Gronhmd, TralelmikCentrum.
- Trae Pjecer; pp. 1-35.
- United States District Court Eastern of Wisconsin; Pervan Testimony; Trial Day 5 (Official Transcript); pp. 1101-1292.
- United States District Court North Carolina; *Pergo (Europe) AB v Unilin Beheer BV*, Civil. Action No. 5:08-CV-91; Joint Stipulation of Dismissal.
- United States District Court of North Carolina; *Pergo (Europe) AB v Unilin Beheer BV*. Civil Action No. 5:08-CV-91-H3; 91-H3; Plaintiffs Original Complaint for Patent Infringement.
- United States District Court of North Carolina; *Pergo (Europe) AB v Unilin Beheer BV*. Civil Action No. 5:08-CV-91-H3; 91-H3; Answer and Counterclaim of Defendant.
- Valinge Innovation AB; "Choosing the Locking System".
- Webster's, Dictionary, p. 862, definition of scarf.
- Final Office Action for U.S. Appl. No. 12/747,454 dated Feb. 24, 2014.
- Re-Issued Pending U.S. Appl. No. 14/044,572, and Reissue Declaration Filed in Accordance With MPEP 1414, both filed Oct. 2, 2013.
- Notice of Allowance for U.S. Appl. No. 13/086,931 dated Jan. 31, 2014.
- Non-Final Office Action for U.S. Appl. 13/957,971 dated Feb. 20, 2014.
- Notice of Allowance for U.S. Appl. No. 13/086,931 dated Mar. 18, 2014.

(56)

References Cited**OTHER PUBLICATIONS**

Non-final Office Action for U.S. Appl. No. 13/620,098 dated Mar. 21, 2014.
 Supplemental Notice of Allowance for U.S. Appl. No. 13/086,931 dated Apr. 14, 2014.
 Final Office Action for U.S. Appl. No. 13/204,481 dated Apr. 22, 2014.
 Final Office Action for U.S. Appl. No. 13/463,329 dated May 16, 2014.
 Restriction Requirement for U.S. Appl. No. 14/076,879 dated May 23, 2014.
 Non-Final Office Action for U.S. Appl. No. 14/097,001 dated Jun. 12, 2014.
 Non-Final Office Action for U.S. Appl. No. 14/098,187 dated Jun. 16, 2014.
 Notice of Allowance for U.S. Appl. No. 13/567,933 dated Jun. 17, 2014.
 Non-Final Office Action for U.S. Appl. No. 14/223,365 dated Jul. 3, 2014.
 Notice of Allowance for U.S. Appl. No. 13/620,098 dated Jul. 22, 2014.
 European Patent Office Board of Appeal Decision for Application No. 01906461.7 dated Jul. 24, 2014.
 Non-Final Office Action for U.S. Appl. No. 14/086,724 dated Aug. 1, 2014.
 Final Office Action for U.S. Appl. No. 13/957,971 dated Sep. 3, 2014.
 Non-final Office Action for U.S. Appl. No. 12/747,454 dated Sep. 12, 2014.
 Notice of Allowance for U.S. Appl. No. 13/620,098 dated Sep. 18, 2014.
 Non-Final Office Action for U.S. Appl. No. 14/076,879 dated Oct. 14, 2014.
 Notice of Allowance for U.S. Appl. No. 13/567,933 dated Oct. 16, 2014.
 Final Office Action for U.S. Appl. No. 13/204,481 dated Oct. 30, 2014.
 Notice of Allowance for U.S. Appl. No. 14/223,365 dated Nov. 5, 2014.
 Advisory Action for U.S. Appl. No. 13/957,971 dated Dec. 17, 2014.
 Notice of Allowance for U.S. Appl. No. 14/097,001 dated Dec. 24, 2014.
 Notice of Allowance for U.S. Appl. No. 14/098,187 dated Dec. 26, 2014.
 Notice of Allowance for U.S. Appl. No. 13/463,329 dated Dec. 31, 2014.
 Final Office Action for U.S. Appl. No. 14/086,724 dated Jan. 16, 2015.
 Notice of Allowance for U.S. Appl. No. 13/860,315 dated Jan. 20, 2015.
 Non-Final Office Action for U.S. Appl. No. 13/957,971 dated Jan. 30, 2015.
 Notice of Allowance for U.S. Appl. No. 13/567,933 dated Feb. 4, 2015.
 Final Office Action for U.S. Appl. No. 14/076,879 dated Mar. 4, 2015.
 Notice of Allowance for U.S. Appl. No. 13/860,315 dated Mar. 5, 2015.
 Non-Final Office Action for U.S. Appl. No. 13/204,481 dated Mar. 25, 2015.

Non-Final Office Action for U.S. Appl. No. 14/456,755 dated Mar. 27, 2015.
 Notice of Allowance for U.S. Appl. No. 13/860,315 dated Apr. 6, 2015.
 Non-Final Office Action for U.S. Appl. No. 14/044,572 dated Apr. 6, 2015.
 Notice of Allowance for U.S. Appl. No. 14/098,187 dated Apr. 8, 2015.
 Notice of Allowance for U.S. Appl. No. 14/086,724 dated Apr. 15, 2015.
 Notice of Allowance for U.S. Appl. No. 14/097,001 dated Apr. 15, 2015.
 Non-Final Office Action for U.S. Appl. No. 14/658,954 dated Apr. 24, 2015.
 Final Office Action for U.S. Appl. No. 14/076,879 dated Apr. 24, 2015.
 Notice of Allowance for U.S. Appl. No. 13/048,646 dated May 14, 2015.
 Notice of Allowance for U.S. Appl. No. 13/567,933 dated May 22, 2015.
 Notice of Allowance for U.S. Appl. No. 14/086,724 dated Jun. 1, 2015.
 Final Office Action for U.S. Appl. No. 13/957,971 dated Aug. 6, 2015.
 Notice of Allowance for U.S. Appl. No. 13/860,315 dated Aug. 21, 2015.
 Notice of Allowance for U.S. Appl. No. 14/098,187 dated Sep. 10, 2015.
 Notice of Allowance for U.S. Appl. No. 13/567,933 dated Sep. 15, 2015.
 Notice of Allowance for U.S. Appl. No. 14/097,001 dated Sep. 16, 2015.
 Final Office Action for U.S. Appl. No. 13/204,481 dated Sep. 21, 2015.
 Final Office Action for U.S. Appl. No. 14/076,879 dated Oct. 22, 2015.
 Final Office Action for U.S. Appl. No. 14/456,755 dated Oct. 27, 2015.
 Final Office Action for U.S. Appl. No. 14/658,954 dated Nov. 9, 2015.
 Non-Final Office Action for U.S. Appl. No. 13/492,512 dated Nov. 17, 2015.
 Advisory Action for U.S. Appl. No. 13/957,971 dated Nov. 30, 2015.
 Notice of Allowance for U.S. Appl. No. 13/860,315 dated Dec. 9, 2015.
 Non-Final Office Action for U.S. Appl. No. 13/957,971 dated Dec. 18, 2015.
 Restriction Requirement for U.S. Appl. No. 14/844,877 dated Dec. 31, 2015.
 Non-Final Office Action for U.S. Appl. No. 14/821,293 dated Feb. 2, 2016.
 Notice of Allowance for U.S. Appl. No. 13/204,481 dated Feb. 3, 2016.
 U.S. Appl. No. 15/043,083, filed Feb. 12, 2016.
 Advisory Action for U.S. Appl. No. 14/658,954 dated Mar. 3, 2016.
 Final Office Action for U.S. Appl. No. 14/044,572 dated Mar. 18, 2016.
 Notice of Allowance for U.S. Appl. No. 14/456,755 dated Apr. 6, 2016.
 U.S. Appl. No. 15/131,977, filed Apr. 18, 2016.
 Notice of Allowance for U.S. Appl. No. 13/957,971 dated May 9, 2016.

* cited by examiner

Fig. 1

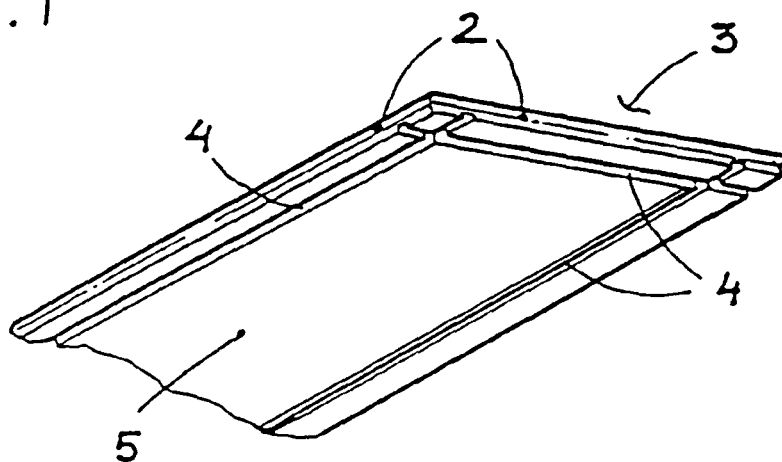


Fig. 2a

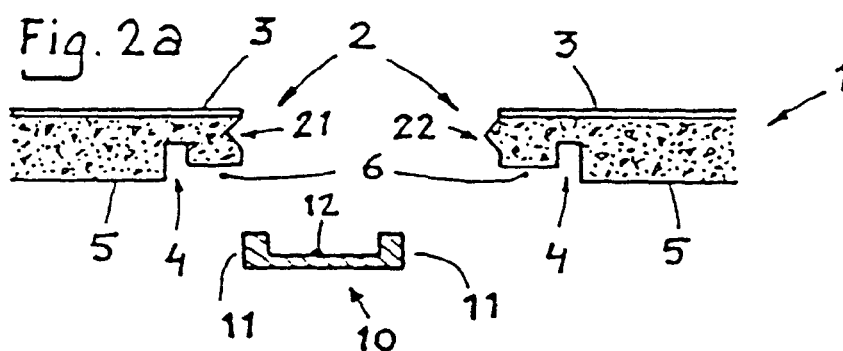


Fig. 2b

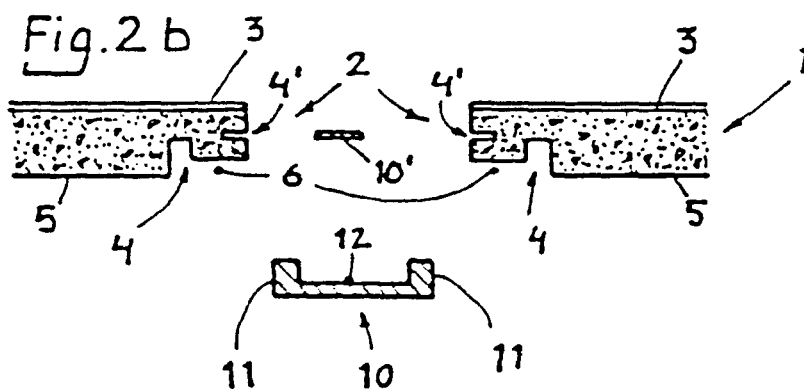


Fig. 2c

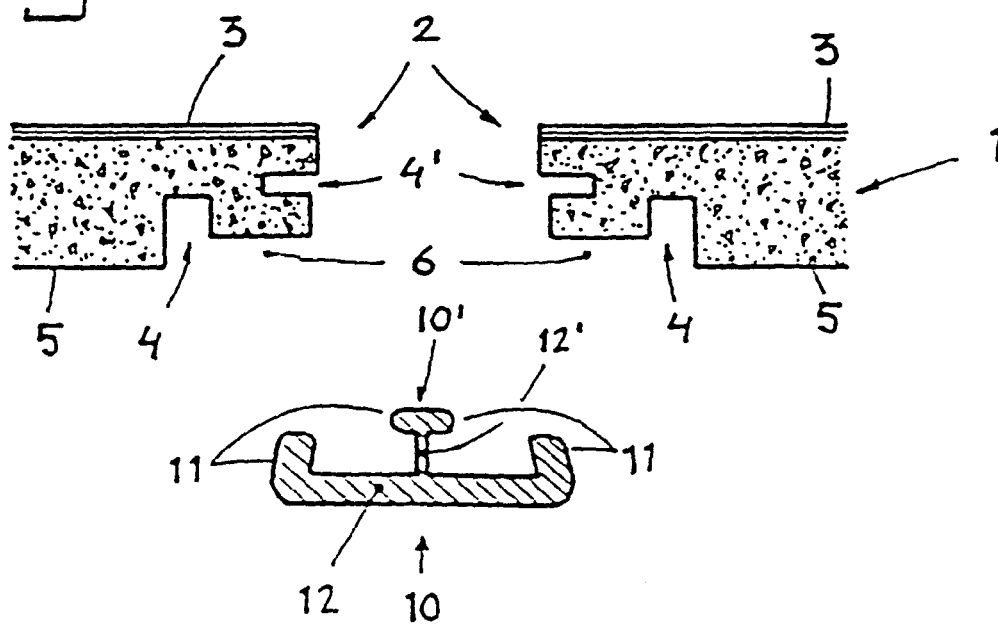


Fig. 3

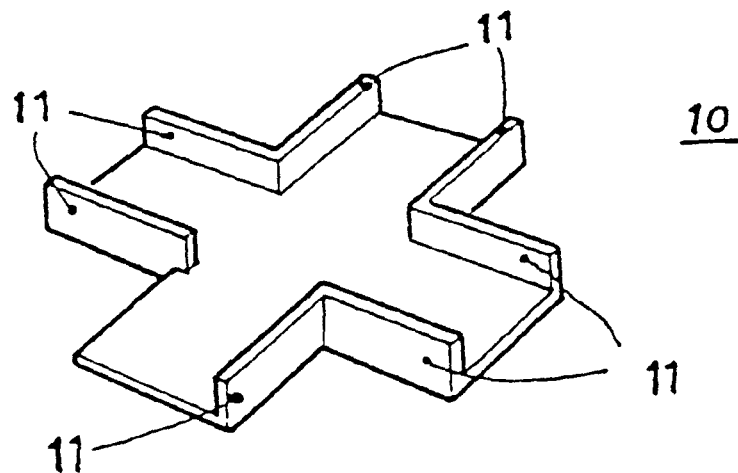


Fig. 4

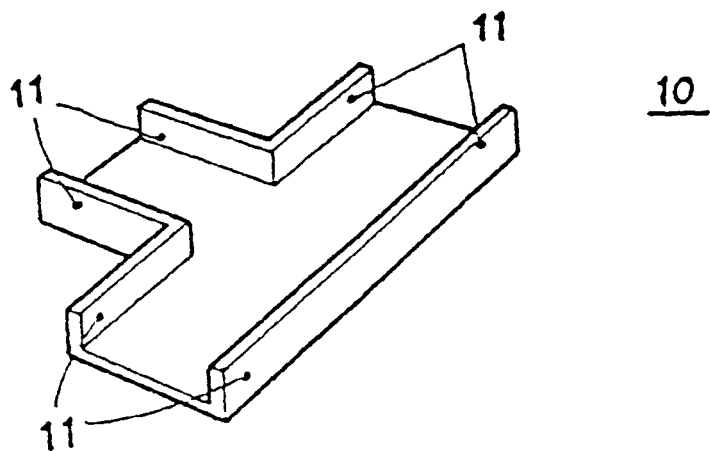


Fig. 5

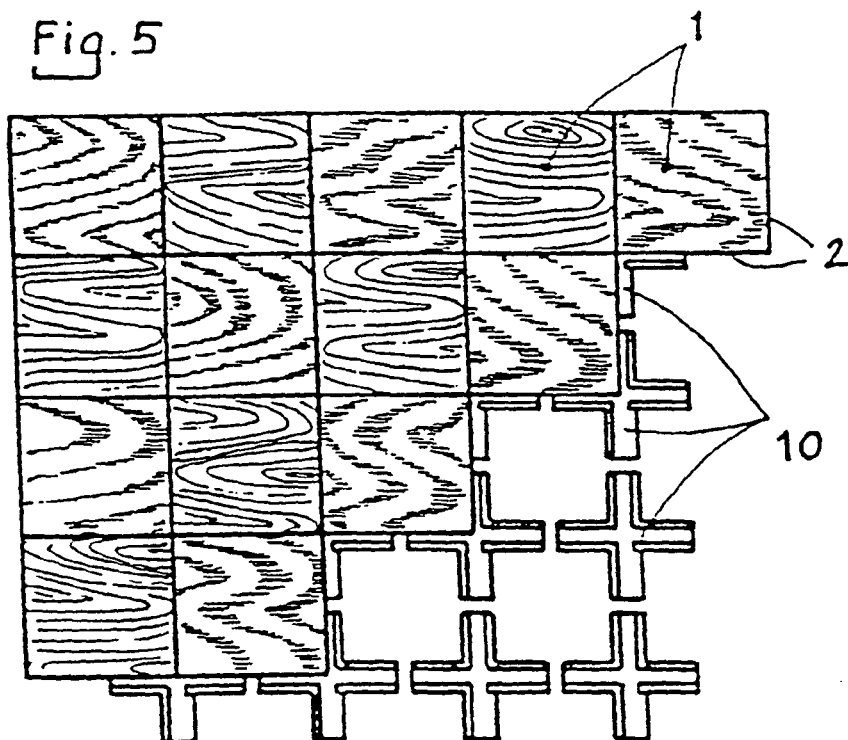
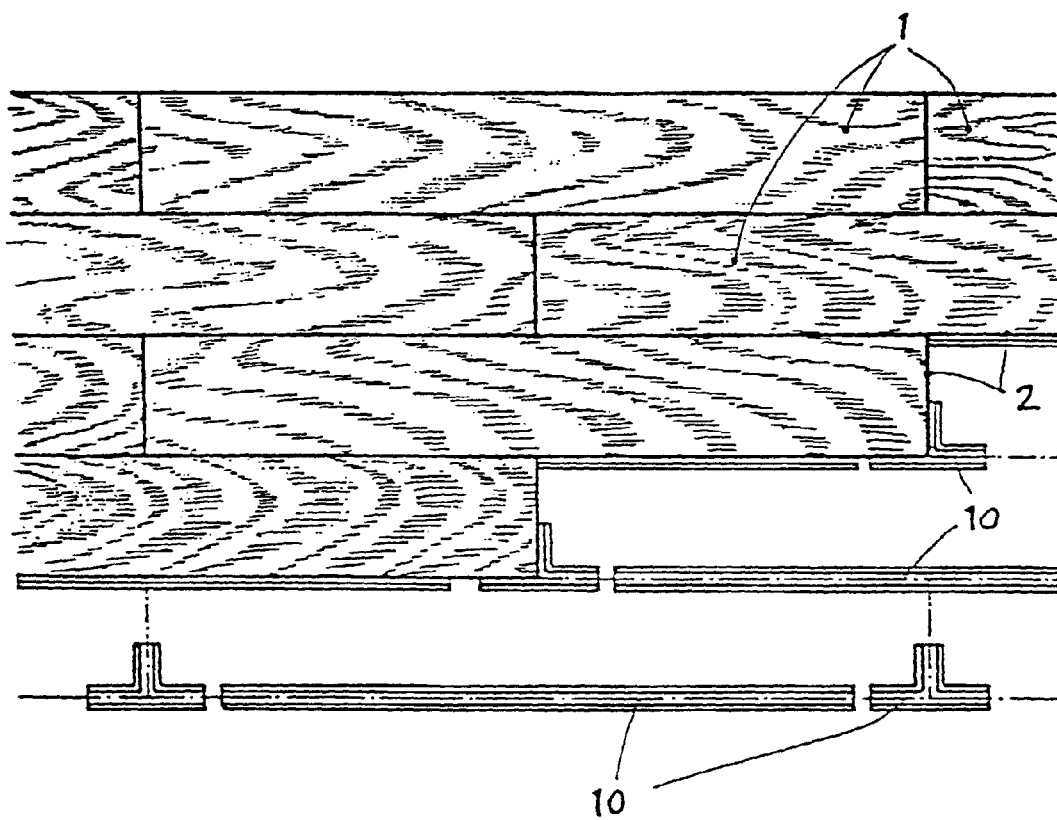
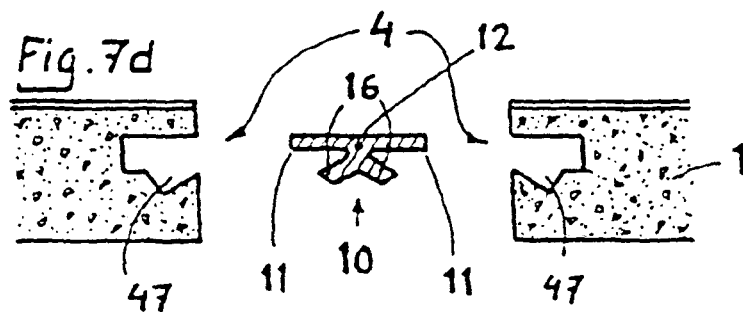
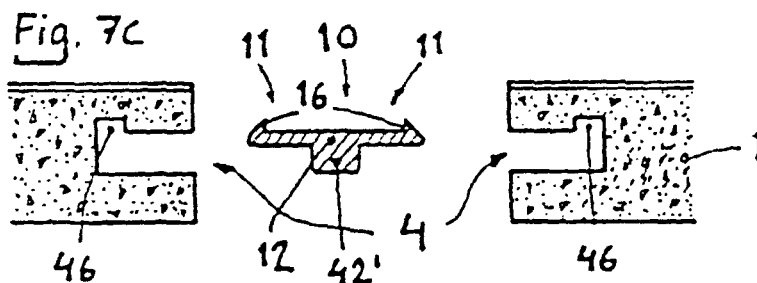
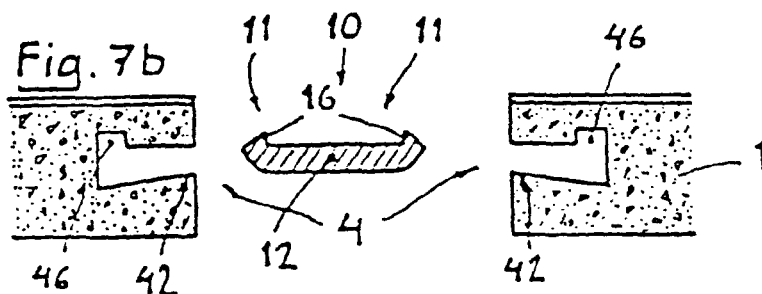
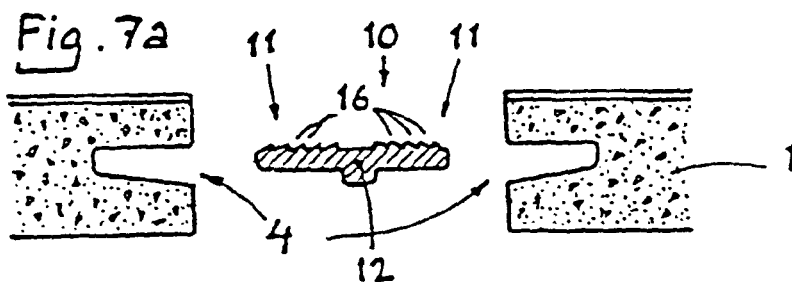


Fig. 6





1

**FLOORING MATERIAL COMPRISING
FLOORING ELEMENTS WHICH ARE
ASSEMBLED BY MEANS OF SEPARATE
FLOORING ELEMENTS**

**CROSS-REFERENCE TO RELATED
APPLICATIONS**

This application is a continuation of and claims priority to U.S. application Ser. No. 11/185,724 filed Jul. 21, 2005 which is a divisional application of U.S. application Ser. No. 10/802,779, filed Mar. 18, 2004, which, in turn, is a divisional application of U.S. application Ser. No. 09/806,994, filed May 31, 2001, which is a §371 application of International Application Ser. No. PCT/SE99/01699, claiming the benefit of Swedish Application No. 9803379-8, filed Oct. 6, 1998, the entire disclosures of which are herein incorporated by reference in their entirety.

The present invention relates to a flooring material comprising board shaped flooring elements which are assembled by means of separate joining profiles.

Prefabricated floor boards provided with tongue and groove at the edges are quite common nowadays. These can be installed by the average handy man as they are very easy to install. Such floors can, for example, be constituted of solid wood, fibre board or particle board. These are most often provided with a surface layer such as lacquer, or some kind of laminate. The boards are most often installed by being glued via tongue and groove. The most common types of tongue and groove are however burdened with the disadvantage to form gaps of varying width between the floor boards in cases where the installer hasn't been thorough enough. Dirt will easily collect in such gaps. Moisture will furthermore enter the gaps which will cause the core to expand in cases where it is made of wood, fibre board or particle board, which usually is the case. The expansion will cause the surface layer to rise closest to the edges of the joint which radically reduces the useful life of the floor since the surface layer will be exposed to an exceptional wear. Different types of tensioning devices, forcing the floor boards together during installation can be used to avoid such gaps. This operation is however more or less awkward. It is therefore desirable to achieve a joint which is self-guiding and thereby automatically finds the correct position. Such a joint would also be possible to utilise in floors where no glue is to be used.

Such a joint is known through WO 94/26999 which deals with a system to join two floor boards. The floor boards are provided with a locking device at the rear sides. It is, however, shown in the figures with accompanying description that the floor boards are provided with profiles on the lower side at a first long side and short side. These profiles, which extends outside the floor board itself, is provided with an upwards directed lip which fits into grooves on the lower side of a corresponding floor board. These grooves are arranged on the second short side and long side of this floor board. The floor boards are furthermore provided with a traditional tongue and groove on the edges. The intentions are that the profiles shall bend downwards and then to snap back into the groove when assembled. The profiles are integrated with the floor boards through folding or alternatively, through gluing.

The invention according to WO 94/26999 is however burdened with the disadvantage that the profiles are located in a very exposed position and will easily be damaged during handling. According to WO 94/26999, the floor boards may be joined without the lip having to touch the contact surface

2

of the groove at tolerances as small as ± 0.2 mm. The profiles are easily deformed during manufacturing, transport and installation of the relatively heavy floor boards since the profiles are located in a very exposed position. Further deformation of the delicate joining profiles is probable since the intentions are that it should be possible to disassemble and reinstall the floor boards according to WO 94/26999. Such deformation will obstruct, and in serious cases even make assembly of the floor boards impossible.

It seems, from WO 94/26999 to be desired to have a clearance between the contact surfaces of the lip and the groove. A tolerance of ± 0.2 mm is mentioned in the application. The clearance seems to be marked Δ in the Figures. Such a clearance will naturally cause undesired gaps between the floor boards. Dirt and moisture can penetrate into these gaps.

Another disadvantage is that the tongue, located on two of the edges, must be tooled from the base material which will loss of the surface layer. Such a surface layer will most often be constituted of thermosetting laminate and is normally the most costly part of a laminate floor. A surface layer of thermosetting laminate will furthermore cause an extensive wear on the tools used for milling.

Another disadvantage becomes clear when performing a life-cycle analysis on the floor boards according to WO 94/26999. According to one preferred embodiment of WO 94/26999, the joining profile is constituted of aluminium. Since it constitutes a part integrated with the floor board it will be practically impossible to recycle the floor board without a very labour-intensive process. The inevitable cutting of the floor board will also be very difficult, utilising common tools, as both aluminium, thermosetting laminate and core will have to be cut at the same time.

It is also known through WO 97/47834 to manufacture a joint where the floor boards are joined so that they are locked together in the horizontal direction. According to this invention a traditional tongue has been provided with heel on the lower side. The heel has a counterpart in a recess in the groove of the opposite side of the floor board. The lower cheek of the groove will be bent away during the assembly and will then snap back when the floor board is in the correct position. The snap-joining parts, i.e. the tongue and groove, is in opposite to the invention according to WO 94/26999 above, where they are constituted by separate parts, seems to be manufactured monolithically from the core of the floor board. WO 97/47834 does also show how the tongue and groove with heels and recesses according to the invention is tooled by means of cutting machining. This invention does also have the disadvantage that the tongue, and particularly, the lower cheek of the groove will easily be damaged during normal handling even though they protrudes less than in the invention according to WO 94/26999 above.

Also WO 97/47834 does have the disadvantage that both tongue and groove will have to be tooled in a way that causes loss of the costly top surface. This tooling will also cause an extensive wear on tools used.

The invention according to WO 97/47834 presumes a certain amount of resilient properties in the core material. The material normally used is not very suitable if a resilient property is desired. MDF (medium density fibre board) or HDF (high density fibre board) should according to WO 97/47834 be suitable as core material. The resilient properties of these materials are however, rather poor, whereby the risk for crack formation, parallel to the top surface, ought to be great.

The invention according to WO 93/13280 deals with a form of clip intended to be used for holding floor boards

together. The floor boards are, besides being provided with a traditional tongue and groove, with known disadvantages, also provided with a single groove on the lower side of the floor board. The floor boards rests on the clip whereby a great number of clips will have to be used as the floor otherwise will be resilient. The distance formed between the floor boards and the surface beneath will furthermore cause acoustic resonance. This will give the floor a noisy character and a higher sound level. This is not desired.

The above mentioned problems are solved through the present invention, whereby a floor that endures handling, demands a minimum of machining of the decorative top surface and is easy to install has been achieved. Accordingly, the invention relates to a flooring material comprising board shaped floor elements with a mainly square or rectangular shape. The floor elements are provided with edges, a lower side and a decorative upper surface. The floor elements are intended to be joined by means of separate joining profiles. The invention is characterised in that all four edges of the floor elements are provided with one notch-like groove each. The grooves are arranged parallel to its respective edge. The joining profiles are provided with lips arranged in pairs. The lips are intended to each be received by one of the grooves so that the floor element, with the grooves at the adjacent edges will be guided or fixed vertically via the lips of a joining profile. The lips are joined by a middle section of the joining profile. The grooves are furthermore provided with an undercut while the lips are provided with hooks that matches the undercut. Adjacent floor elements will hereby be guided or fixed horizontally via the undercuts and the hooks. According to one alternative the lips are provided with gripping hooks. Such gripping hooks can be used in grooves without undercut by making them sharp edged.

The grooves are suitably provided with a support for the middle section of the joining profiles. It will thereby be possible to make this embodiment dismountable where it is chosen to install the floor without using glue.

The joining profiles are suitably shaped as extended profiles which suitably are manufactured through extrusion which is a well known and rational method. The joining profiles are suitably shaped as extended lengths or rolls which can be cut to the desired length. The length of the joining profiles considerably exceeds the length of a floor element, before being cut. An advantage with such long profiles is that they can be laid over the whole width of the floor and will thereby reduce the risk for deviations and gaps in the floor since it bridges the lateral joints of the floor. Such bridging of the lateral joints can of course be used even if the joining profiles have the same length as, or is shorter than the floor elements. Shorter pieces of joining profiles is suitably used when it comes to the lateral joints of the floor. The floor elements may alternatively be provided with traditional tongue and groove in the lateral joint edges.

The flooring material comprising the floor elements and joining profiles above is very suited for installations of floors where no glue is needed. It is, of course possible to use glue or double-faced adhesive tape in order to make the installation completely permanent. The glue or tape is then suitably placed on the surfaces of the joining profile located between the lips and/or on the edges of the floor element.

The joining profiles are in the present invention a separate part in opposite to earlier known and cited flooring materials where the joining is made through tongue and groove, profiles or heels. This will give great advantages when handling the floors in connection to manufacturing, transport and installation as traditional joining parts normally are very delicate and sensitive to blows. These parts must, of manu-

facturing technological reasons, be made of fibre board, particle board or thin aluminium sheets which all are easy to either break or deform. This will normally lead to that the floor elements has to be rejected. Joining profiles according to the present invention can be made of a multitude of materials and by means of many different manufacturing methods. Among the most suitable methods can, however, be mentioned injection moulding for the plus-shaped embodiment of a joining profile and extrusion for the extended embodiment of joining profile. Suitable materials are thermoplastic materials such as poly olefins, polystyrene, polyvinyl chloride or acrylnitril-butadiene-styrene-copolymer. These can suitably be filled with for example wood powder or time in order to increase the dimension stability as well as increasing the adhesion when being glued.

The invention may also relate to a flooring material comprising board shaped floor elements with a mainly square or rectangular shape. The floor elements are provided with edges, a lower side and a decorative upper surface. The floor elements are joined by means of separate joining profiles. The characterising features in this embodiment are that the floor elements are provided with grooves on at least two opposite sides. The grooves are arranged parallel to its respective edge on the lower side of the floor element. The joining profiles are provided with lips arranged in pairs, which lips are intended to each be received by one of the grooves of the floor elements so that two adjacent floor elements with the grooves at the adjacent edges are guided or fixed horizontally via the lips of a joining profile. The lips are joined by a middle section of the joining profile.

The grooves are placed on a distance from the closest edge of less than half, preferably less than one quarter of the width of the floor element.

The floor elements are suitably provided with grooves on all four edges. The distance between each groove and the closest edge is mainly the same.

The section located between the edges and its closest edge is preferably of thickness which is thinner than the largest thickness of the floor through a recess located on the lower side.

The edges are suitably provided with a vertical guiding by providing a first edge with a preferably V-shaped longitudinal groove with a depth less than 1.8 times, preferably 0.9 times the greatest thickness of the floor. An opposite edge, as related to the first edge, is provided with a matching protruding profile.

The edges are alternatively provided with a vertical guiding by providing two adjacent edges with each a preferably V-shaped longitudinal groove with a depth of less than 1.8 times, preferably less than 0.9 times the greatest thickness of the floor element. The two remaining edges are provided with a protruding profile that matches the longitudinal groove.

The distance between the, in pairs, arranged lips of the joining profile is preferably somewhat smaller than the distance between the grooves placed on each side, and closest to, the joint between two adjacent floor elements. The joining profile will hereby exert a tensioning force on the joint.

The joining profiles are suitably manufactured as extended lengths, through extrusion which is a well-known and rational manufacturing method. The joining profiles are shaped as extended lengths or rolls which can be cut to the desired length. The length of the joining profiles considerably exceeds the length of a floor element. One advantage with such long joining profiles is that they can be laid over the whole width of a floor and will thereby reduce the risk

5

for deviations and gaps in the floor as it bridges the lateral joints in the floor. Such bridging of the lateral joints can of course be used even if the joining profiles have the same length as, or is shorter than the floor elements. Shorter pieces of joining profiles is suitably used when it comes to the lateral joints of the floor. These are suitably installed gradually as every new floor element is added to a row. The floor elements may alternatively be provided with traditional tongue and groove in the lateral joint edges.

According to one variation of the embodiment above, the joining profiles are intended to be placed in corner where four floor elements meets. The joining profiles is shaped as a plus with four cheeks, as seen from above. The first three cheeks, which together with the fourth forms the plus-shaped joining profile, are provided two lips, arranged in pairs, each. The lips are intended to be placed on each one side of a joint. The fourth cheek is provided with only one lip placed on one side of the joint.

The plus-shaped joining profiles are best suited for installation of square floor elements and will automatically give an excellent guiding of both the lateral and longitudinal joints. These are suitably provided with cheeks that are only somewhat shorter than the half the short side of the floor element. The cheek length is calculated as, from the centre of the joining profile to its outer edge. The plus-shaped joining profiles are also suited for installation of rectangular floor elements in cases where the lateral joints are to coincide. The length of the cheeks are hereby somewhat shorter than half the width of the floor element. Extended profiles can be cut and installed in the intermediate space on the long side between two plus-shaped joining profiles to reinforce the long side joint. In cases where the lateral joints are to be displaced from row to row it is possible to use a T-shaped joining profile which has three cheeks instead of four. This profile is suitably also provided with cheeks of length somewhat shorter than the half the width of the floor element. Flooring materials comprising the floor elements and joining profiles above are very suited where it is desired to install floors without having to use glue. It is of course possible to use glue or double-faced adhesive tape in order to make the installation irreversibly permanent. The glue or the tape is then suitably applied to the surfaces located between the lips, and on the edges.

The joining profiles are, unlike earlier known and herein mentioned flooring materials where the joining is achieved through tongue and groove, profiles or heels, a separate part. This will give great advantages when handling the floors in connection to manufacturing, transport and assembly as the traditional joining parts are very delicate and sensitive to blows. These parts must, of manufacturing technological reasons, be made of fibre board, particle board or thin aluminium sheets which all are easy to either break or deform. This will normally lead to that the floor elements has to be rejected. Joining profiles according to the present invention can be made of a multitude of materials and by means of many different manufacturing methods. Among the most suitable methods can, however, be mentioned injection moulding for the plus-shaped embodiment of a joining profile and extrusion for the extended embodiment of joining profile. Suitable materials are thermoplastic materials such as polyolefins, polystyrene, polyvinyl chloride or acrylonitril-butadiene-styrene-copolymer. These can suitably be filled with for example wood powder or lime in order to increase the dimension stability as well as increasing the adhesion when being glued.

6

The invention is described further together with enclosed figures showing different embodiments of the invention whereby,

FIG. 1 shows, in perspective view, seen from below, an embodiment of a floor element **1** to a flooring material.

FIGS. 2a-2c shows in exploded view and in cross-section different embodiments of a flooring material.

FIG. 3 shows an embodiment of a joining profile **10** to a flooring material.

FIG. 4 shows another embodiment of a joining profile **10** to a flooring material.

FIG. 5 shows a flooring material according to the invention where square floor elements **1** and plus-shaped joining profiles **10** shown in FIG. 3 is shown. The floor is only partly installed in order to facilitate understanding of the function.

FIG. 6 shows a flooring material according to the invention where rectangular floor elements **1** and T-shaped joining profiles **10**, as shown in FIG. 4 and extended joining profiles **10** are used. The floor is only partly installed in order to facilitate understanding of the function.

FIGS. 7a-d shows different preferred embodiments of joints with floor elements **1** which are joined by means of joining profiles **10** via notch-shaped grooves **4** in the edges **2** of the floor boards **1**.

Accordingly, FIG. 1 shows, in perspective seen aslant from below, an embodiment of a floor element **1** to a flooring material. The floor element **1** has rectangular shape and is provided with edges **2**, a lower side **5** and a decorative upper surface **3**. The floor elements **1** are joined by means of separate joining profiles **10** (FIGS. 2-6). The floor element **1** is provided with a groove **4** at each of the edges **2**. The grooves **4** are arranged parallel to its respective edge **2**. The joining profiles **10** (e.g. 2-6) are provided with lips **11** (FIGS. 2-6), arranged in pairs, which each are intended to be received by one of the grooves **4** of the floor element **1**. Two adjacent floor elements **1** with the grooves **4** at the adjacent edges **2** are guided or locked horizontally by means of the lips **11** of the joining profile **10**. The floor elements **1** most often comprises a core to which an upper decorative layer has been applied. The core most often consists of wood particle or fibre bonded together by glue or resin. It might be advantageous to treat the surface closest to the joint in cases where the floor will be exposed to moisture, since the wood in the core is sensitive to moisture. This surface treatment may suitably include resin, wax or some kind of lacquer. It is not necessary to coat the joint if it is to be glued since the glue itself will protect the core from moisture penetration. The decorative upper surface **3** is constituted by a decorative paper impregnated with melamine-formaldehyde resin. One or more layers of so-called overlay papers made of α -cellulose, impregnated with melamine-formaldehyde resin are possibly placed on top of this. The abrasion resistance can be improved further by sprinkling one or more of the layers with hard particles of for example α -aluminium oxide, silicon carbide or silicon oxide in connection to the impregnation. The lower side **5** may suitably be coated with lacquer or a layer of paper and resin.

FIGS. 2a-2c shows in exploded view and in cross-section, different embodiments of a flooring material. The floor elements **1** are provided with edges **2**, a lower side **5** and a decorative upper surface **3**. The floor elements **1** are joined by means of separate joining profiles **10**. The floor elements **1** are at two opposite edges **2** provided with one groove **4** each. The grooves **4** are arranged parallel to its respective edge **2**. The grooves **4** are arranged on the lower side **4** at a distance from the closest edge **2** of the less than one fourth of the width of the floor element **1**. The section located

7

between the edges 2 and their respective closest groove 4 has a thickness which is smaller than the greatest thickness of the floor board 1 through a recess 6 located on the lower side 5. The thickness of the floor is normally between 5 and 15 mm whereby a suitable difference in thickness at the recess 6 and the main floor thickness is 1-5 mm. The edges 2 are provided with a vertical guiding by a providing a first edge with a V-shaped longitudinal groove 21 (FIG. 2a) with a depth less 0.9 times the greatest floor thickness. The opposite edge 2 is provided with a matching profile 22 (FIG. 2a). The joining profiles 10 are provided with lips 11 arranged in pairs, which lips each are intended to be received by each one groove 4 of the floor elements 1 so that to adjacent floor elements 1 with the grooves 4 at the adjacent edges 2 are guided or fixed horizontally via the lips 11 of a joining profile 10. The floor elements 1 may, instead of being provided with V-shaped grooves 21 with matching profile 22, alternatively be provided with a notch-like groove 4' (FIGS. 2b-2c) in all four edges 2, which grooves 4' (FIGS. 2b-2c) are intended to receive each one of the lips 11 of a second joining profile 10'. The second joining profile 10' may either be a separate part (FIG. 2b) or be joined with the joining profile 10 via a rib 12' (FIG. 2c). The lips 11 are connected by a middle section 12 of the joining profile 10. The distance between the, in pairs, arranged lips 11 of the joining profile 10 is somewhat smaller than the distance between the grooves 4 arranged on each one side of, and closest to, the joint between two adjacent floor elements 1. The floor elements 1 will thereby be forced together whereby gaps are avoided. The joining profiles 10 and 10' are manufactured as extended lengths or rolls which may be cut into the desired length during installation. These lengths considerably exceeds the length of the floor elements 1. The embodiments shown in the FIGS. 2a-c all gives a minimum of machining a minimum of material loss during manufacturing.

FIG. 3 shows, in perspective view seen from above, an embodiment of a joining profile 10 to a flooring material. The floor elements 1 are, as shown in FIG. 1, provided with edges 2, a lower side 5 and a decorative upper surface 3. The floor elements 1 are joined by means of separate joining profiles 10. The floor elements 1 are, as shown in FIG. 1, provided with one groove 4 each, at two opposite edges 2. The grooves 4 are arranged parallel to its respective edge 2. The grooves 4 are placed on the lower side 5 at a distance from the closest edge 2 of less than one fourth of the width of the floor element 1. The section located between the edges 2 and their respective closest groove 4 has a thickness which is smaller than the greatest thickness of the floor board 1 through a recess 6 located on the lower side 5. The thickness of the floor is normally between 5 and 15 mm whereby a suitable difference in thickness at the recess 6 and the main floor thickness is 1-5 mm. The edges 2 may, as shown in the FIGS. 2a-c, be provided with a vertical guiding through a V-shaped groove 21 (FIG. 2a) with matching profile 22 (FIG. 2a) or by a notch-like grooves 4' (FIGS. 2b-c) in all four edges 2 with a matching second joining profile 10' (FIGS. 2b-c). The plus-shaped joining profile 10 (FIG. 3) is provided with lips 11 arranged in pairs, which lips 11 each are intended to be received by one of the grooves 4 of the floor element 1 so that adjacent floor element 1, with the grooves at the adjacent edges 2 are guided or fixed horizontally via the lips 11 of a joining profile 10. The joining profile is intended to be placed in the corner where four floor elements 1 meet. The joining profile 10 is, as seen from above shaped as a plus with four cheeks, where the first three cheeks, which together with the fourth one forms the plus-

8

shaped joining profile 10, is provided with two lips 11 arranged in pairs each, which are intended to be placed at either side of a joint. The fourth cheek is provided with only one lip 11 arranged on one side of the joint. The reason why the fourth cheek is provided with only one lip 11 is that the last floor element 1 joined with such a joining profile 10 must be slid in from the side in cases where the floor elements 1 are provided with a vertical guiding as shown in the FIGS. 2a-c. The joining profile 10 as shown in FIG. 3 is used on floors where both longitudinal and lateral joints is to coincide.

FIG. 4 shows in perspective another embodiment of a joining profile 10 to a flooring material. The joining profile 10 corresponds in the main to the one described in connection to FIG. 3. The joining profile 10 showed in FIG. 4 is however provided with only three cheeks and can thereby be described as T-shaped. The joining profile 10 as shown in FIG. 3 is used in floors where only the longitudinal or lateral joints is to coincide.

FIGS. 5 and 6 shows a flooring material according to the invention where square and rectangular floor elements 1 respectively and plus-shaped and T-shaped joining profiles 10 respectively as shown in FIGS. 3 and 4 are used. The flooring material is only partly installed in order to facilitate understanding of the function. The plus-shaped profiles are best suited when installing square floor elements 1 and will automatically an excellent guiding of the joints in both longitudinal and lateral direction. These are suitably provided with cheeks being somewhat shorter than half the side of a floor element 1. The length of a cheek is calculated as, from the centre of the joining profile 10 to its outer edge. The plus-shaped joining profiles are also suited for installation of rectangular floor elements 1 in cases where coinciding lateral joints is desired. The length of the cheeks is here somewhat shorter than the short side edge of the floor element 1. Extended profiles 10 can be cut and mounted in the intermediate space between two plus-shaped profiles 10 in order to reinforce the long side joint of the floor board 1.

It is possible to use a T-shaped joining profile which has three cheeks instead of four in cases where a position of the lateral joints shifting from row to row (FIG. 6) is desired. This installation pattern is most often used when installing rectangular floor elements 1. The length of the cheeks is also here, somewhat smaller than half the short side of the floor elements 1. The flooring material comprising the above floor elements 1 and joining profiles 10 are very suited for installations where it is desired to avoid use of glue. It is, of course, possible to use glue or double faced adhesive tape in order to make the installation completely permanent. The glue or tape is then suitably applied to the surfaces of the joining profile 10 that are located between the lips 11 and on the edges 2 (FIG. 2).

It is also possible to use only extended profiles 10 when installing floor elements 1. These are then suitably cut to cover the full width of the floor. The joining profiles 10 will then extend in the same direction as the rectangular floor elements 1. Small pieces are cut from joining profiles 10. These small pieces are placed in the lateral joints as every new floor element 1 is installed. It is suitable to bring these small pieces from below into the joint between two assembled floor boards 1.

FIGS. 7a-d shows different embodiments of joints with floor elements 1 which are joined by means of joining profiles 10 via notch-shaped grooves 4 in the edges 2 of the floor boards 1. The floor boards 1 are provided with notch-shaped grooves 4 in all four edges 2. The grooves 4 are each intended to receive one of the lips 11 of the joining profile

10. The lips 11 are provided with gripping hooks 16. The floor can be made snap-joinable by providing the grooves 4 with an undercut 46 (FIGS. 7b-c) and by providing the lips with matching hooks 16 (FIGS. 7b-c). In order to make the joint dismountable, which can be advantageous even if the floor elements are to be glued, the grooves 4 are provided with a support 42 (FIG. 7b) for the middle section 12 of the joining profile 10. The middle section 12 can alternatively be provided with a support 42' (FIG. 7c). Such a floor element 1 is then dismounted by lifting it slightly along the free edge 2, whereby the hook will be disengaged from the undercut 46. The simplest way to achieve such undercuts 46 are through broaching or laser cutting. The floor elements 1 may alternatively be joined through a more shallow undercut 47 (FIG. 7d) which can be achieved with traditional methods such as milling. The embodiments shown in FIGS. 7a-d all give a minimum of cutting and lost material during manufacturing. The joining profiles 10 used in the embodiments shown in FIGS. 7a-d are also manufactured in extended lengths or rolls which are cut to the desired length in connection to the installation of the floor. The joining profiles 10 and/or the floor elements 1 may, of course, be coated with glue or adhesive double-faced tape.

The invention is not limited by the embodiments shown since they can be varied in different ways within the scope of the invention.

The invention claimed is:

1. Flooring material comprising board shaped floor elements with a rectangular oblong shape and a thickness of between 5 and 15 millimeters, the floor elements made of a base material and comprising edges, a lower side and a decorative upper surface, the floor elements comprising a core to which an upper decorative layer has been applied, the decorative upper surface comprising the upper decorative layer, wherein the upper decorative layer comprises a decorative paper impregnated with melamine-formaldehyde resin,

wherein the flooring material further comprises joining profiles, the joining profiles being separate from the base material of the floor element,

wherein the edges and joining profiles allow for two of the floor elements to become mutually fixed adjacent to each other at their respective adjacent edges, such that a horizontal fixation as well as vertical fixation is effective, wherein the horizontal fixation prevents moving apart of the adjacent floor elements in a horizontal direction when in an installed configuration,

wherein the respective adjacent edges comprise each a respective groove, the respective grooves being positioned at least partially opposite each other and defining a common cavity, wherein the vertical fixation is obtained through at least one of the joining profiles, the at least one of the joining profiles being located in the cavity and being shorter than the respective adjacent edges, wherein the at least one of the joining profiles is not involved in the horizontal fixation.

2. The flooring material of claim 1, wherein the horizontal as well as vertical fixation is reversible in that the respective adjacent edges allow adjacent floor elements to become dismounted from the installed configuration.

3. The flooring material of claim 2, wherein the respective adjacent edges allow the adjacent floor elements to become dismounted by lifting one of the floor elements in respect to the other such that portions effective in the horizontal fixation become unlocked.

4. The flooring material of claim 1, wherein the at least one of the joining profiles is formed from an extruded or injection molded plastic material.

5. The flooring material of claim 1, wherein the at least one of the joining profiles is formed from a thermoplastic material selected from a list consisting of polyolefin, polystyrene, polyvinyl chloride and acrylonitril-butadiene-styrene-copolymer.

6. The flooring material of claim 1, wherein the at least one of the joining profiles is formed from a plastic material.

7. The flooring material of claim 6, wherein the plastic material comprises a filler material increasing the dimensional stability of the at least one of the joining profiles.

8. The flooring material of claim 1, wherein the respective adjacent edges and the at least one of the joining profiles are located at adjacent short ends of the floor elements.

9. The flooring material of claim 1, wherein the core comprises a wood particle or wood fiber bonded together by glue or resin.

10. The flooring material of claim 1, wherein the decorative upper surface further comprises one or more layers of overlay papers impregnated with melamine-formaldehyde resin, the one or more layers being placed on top of the decorative paper.

11. The flooring material of claim 1, wherein the at least one of the joining profiles comprises gripping hooks at its upper surface.

12. The flooring material of claim 1, wherein the opposite grooves have a depth smaller than 0.9 times the thickness of the floor elements.

13. Flooring material comprising board shaped floor elements with a rectangular oblong shape, the floor elements made of a base material and comprising edges, a lower side and a decorative upper surface,

wherein the flooring material further comprises joining profiles, the joining profiles being separate from the base material of the floor element,

wherein the edges and joining profiles allow for two of the floor elements to become mutually fixed adjacent to each other at their respective adjacent edges, such that a horizontal fixation as well as vertical fixation is effective, wherein the horizontal fixation prevents the moving apart of the adjacent floor elements in a horizontal direction when in an installed configuration,

wherein the respective adjacent edges comprise each a respective groove, the respective grooves defining a common cavity, wherein the vertical fixation is obtained through at least one of the joining profiles, the at least one of the joining profiles being at least partly located in the cavity, wherein chambers are present in the cavity between a contour of the at least of the joining profiles and the walls of the grooves,

wherein the flooring material at the edges further comprises lips and downwardly open grooves formed at the lower side and being parallel to the respective edges, wherein the horizontal fixation is obtained through an interaction of the lips and grooves formed at the lower side, wherein the edges with the downwardly open grooves, comprise a section, located between the edge and the downwardly open groove, which is of a thickness that is thinner than a largest thickness of the floor elements, through a recess located on the lower surface.

14. Flooring material comprising board shaped floor elements with a rectangular oblong shape, the floor elements made of a base material and comprising edges, a lower side and a decorative upper surface, the floor elements compris-

11

ing a core to which an upper decorative layer has been applied, the decorative upper surface comprising the upper decorative layer,

wherein the flooring material further comprises joining profiles, the joining profiles being separate from the base material of the floor element, 5

wherein the edges and joining profiles allow for two of the floor elements to become mutually fixed adjacent to each other at their respective adjacent edges, such that a horizontal fixation as well as vertical fixation is effective, wherein the horizontal fixation prevents the moving apart of the adjacent floor elements in a horizontal direction when in an installed configuration, 10

wherein the respective adjacent edges comprise each a respective groove, the respective grooves defining a common cavity, wherein the vertical fixation is obtained through at least one of the joining profiles, the at least one of the joining profiles being at least partly located in the cavity, wherein the at least one of the joining profiles includes an upper lateral edge that is chamfered or rounded, 15 20

wherein the flooring material at the edges further comprises lips and downwardly open grooves formed at the

12

lower side and being parallel to the respective edges, wherein the horizontal fixation is obtained through an interaction of the lips and grooves formed at the lower side, wherein the edges with the downwardly open grooves, comprise a section, located between the edge and the downwardly open groove, which is of a thickness that is thinner than a largest thickness of the floor elements, through a recess located on the lower surface.

15. The flooring material of claim 13 or claim 14, wherein the floor elements have a thickness of between 5 and 15 millimeters.

16. The flooring material of claim 13 or claim 14, wherein the at least one of the joining profiles is not involved in the horizontal fixation.

17. The flooring material of claim 13 or claim 14, wherein the at least one of the joining profiles comprises gripping hooks at its upper surface.

18. The flooring material of claim 13 or claim 14, wherein the respective adjacent edges and the at least one of the joining profiles are located at adjacent short ends of the floor elements.

* * * * *